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TRANSACTIONS

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COLLEGE OF PHYSICIANS

OF

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THIRD SERIES

VOLUME THE FORTY-FOURTH

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1922

NOTICE

The present volume of TRANSACTIONS contains the papers read before the College from January, 1922, to December, 1922, inclusive.

The Committee of Publication thinks it proper to say that the College holds itself in no way responsible for the statements, reasonings, or opinions set forth in the various papers published in its TRANSACTIONS.

EDITED BY

WALTER G. ELMER, M.D.

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DORNAN, PRINTER

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OF THE

PRESIDENTS OF THE COLLEGE FROM THE TIME OF ITS INSTITUTION

ELECTED	
1787	JOHN REDMAN
1805	WILLIAM SHIPPEN
1809	ADAM KUHN
1818	THOMAS PARKE
1835	THOMAS C. JAMES[1]
1835	THOMAS T. HEWSON
1848	GEORGE B. WOOD
1879	W. S. W. RUSCHENBERGER
1883	ALFRED STILLÉ
1884	SAMUEL LEWIS[2]
1884	J. M. DA COSTA
1886	S. WEIR MITCHELL
1889	D. HAYES AGNEW
1892	S. WEIR MITCHELL
1895	J. M. DA COSTA
1898	JOHN ASHHURST, JR.
1900	W. W. KEEN
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1904	ARTHUR V. MEIGS
1907	JAMES TYSON
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1913	JAMES CORNELIUS WILSON
1916	RICHARD H. HARTE
1919	WILLIAM J. TAYLOR
1922	THOMAS R. NEILSON

[1] Died four months after his election.
[2] Resigned on account of ill-health.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

1922

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(until February, 1923)

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(until February, 1924)

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Clerk, Alex. Heron Davisson, M.D.

FELLOWS

OF THE

COLLEGE OF PHYSICIANS OF PHILADELPHIA

DECEMBER, 1922

* Non-resident Fellows.
† Fellows who have commuted dues.

ELECTED

1892. Abbott, Alexander Crever, M.D., Sc. D., Dr. P.H., Pro-
1921. fessor of Hygiene and Bacteriology and Director of the School of Hygiene and Public Health; University of Pennsylvania. 4016 Pine St.

1921. Addison, William H. F., A.B., M.D., Professor of Normal Histology and Embryology in the University of Pennsylvania. Medical Laboratories, University of Pennsylvania.

1905. Adler, Lewis H., Jr., M.D., Professor of Diseases of the Rectum in the Philadelphia Polyclinic and College for Graduates in Medicine; formerly Prosector to the Professor of Anatomy in the University of Pennsylvania; Consulting Surgeon to the Charity Hospital. 313 S. Seventeenth St.

1914. Aiken, Thomas Gerald, M.D., Assistant Visiting Physician to the Chester County Hospital, West Chester, Pa.; Pathologist to the Country Branch of the Rush Hospital for Tuberculosis. Berwyn, Pa.

1913. Alexander, Emory G., M.D., Surgeon to St. Christopher's Hospital for Children; Associate Surgeon to the Episcopal Hospital; Clinical Professor of Surgery in the Woman's Medical College of Pennsylvania, Demonstrator of Fracture Dressings in the Jefferson Medical College, and Assistant Surgeon to the Kensington Hospital for Women. 1701 Spruce St.

ELECTED

1906. Allen, Francis Olcott, Jr., A.B., M.D., Surgeon to the Presbyterian and Bryn Mawr Hospitals; Associate Surgeon to the Pennsylvania Hospital. 2216 Walnut St.

1896. Allyn, Herman B., M.D., Physician to the Philadelphia General Hospital. 501 S. Forty-second St.

1888. Anders, James M., M.D., L.L.D., Professor of Medicine and Clinical Medicine in the Medico-Chirurgical College; Officer de l'Instruction Publique. 1605 Walnut St.

1905. Anspach, Brooke M., M.D., Professor of Gynecology in the Jefferson Medical College; Attending Gynecologist, Jefferson Hospital; Gynecologist to the Stetson Hospital; Attending Gynecologist to the Bryn Mawr Hospital. 1827 Spruce St.

1905. Appleman, Leighton F., M.D., Demonstrator of Pharmacy and Materia Medica, and Instructor in Therapeutics in the Jefferson Medical College; Associate Professor of Ophthalmology; Graduate School of Medicine, University of Pennsylvania; Assistant Surgeon to the Wills Eye Hospital; Ophthalmologist to the Frederick Douglass Memorial Hospital and to the Burd School. 308 S. Sixteenth St.

1922. Arnett, John Hancock, A.B., M.D., Assistant in Medicine, and Student's Physician, University Hospital. 324 S. Nineteenth St.

1906. Ashhurst, Astley Paston Cooper, A.B., M.D., Associate in Surgery, School of Medicine, University of Pennsylvania; Associate Professor of Surgery in the Graduate School of Medicine of the Univeristy of Pennsylvania; Surgeon to the Episcopal Hospital and to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases. 2132 Spruce St.

1893. Ashton, Thomas G., M.D., Physician to the Philadelphia General Hospital. 1814 S. Rittenhouse Square.

1920. Astley, George Mason, M.D., Assistant Surgeon, Samaritan Hospital. 5317 Master St.

1914. Austin, J. Harold, B.S. (Univ. of Penna.), M.D., Professor of Research Med., University of Pennsylvania. 2114 De Lancey Place.

1906. Babbitt, James A., A.B., (Yale), A.M. (Haverford), M.D., Associate Professor of Oto-Laryngology, Graduate School of Medicine, University of Pennsylvania; Assistant Laryngologist and Aurist, Lankenau Hospital; Laryngologist

ELECTED

Mary Drexel Children's Hospital; Laryngologist and Aurist, Children's Hospital, Out-patient Department. 2117 Chestnut St.

1910. Baer, Benjamin F., Jr., B.S., M.D., Associate Professor of Ophthalmology; Graduate School of Medicine, University of Pennsylvania; Assistant Ophthalmologist, University Hospital; Consultant Ophthalmologist, Philadelphia Lying-in Charity Hospital. 1927 Spruce St.

†1892. Baker, George Fales, B.S., M.D. 1818 Spruce St.

1911. Baldwin, James Harvey, A.B., M.D., Surgeon to the Methodist Hospital. 1426 Pine St.

1889. Baldy, John Montgomery, M.D., Professor of Gynecology in the Philadelphia Polyclinic; Surgeon to the Gynecean Hospital; Consulting Surgeon to the Jewish and the Frederick Douglass Memorial Hospitals. Devon, Pa.

1916. Balentine, Percival L., M.D., Assistant Surgeon, Wills Eye Hospital; Demonstrator of Ophthalmic Surgery in the Philadelphia Polyclinic. 302 Weightman Building, 1524 Chestnut St.

1898. Balliet, Tilghman M., A.M., M.D., Professor of Therapeutics at Dartmouth College, Hanover, N. H.; Physician to the Old Man's Home. 3920 Sansom St.

1911. Barnard, Everett P., M.D., Obstetrician to the Maternity Hospital; Assistant Instructor in Obstetrics in the University of Pennsylvania. 245 S. Eighteenth St.

1921. Bauer, Edward L., M.D., Consultant Pediatrist, Germantown Hospital; Visiting Physician, Philadelphia Hospital for Contagious Diseases; Assistant Visiting Physician, Children's Hospital of the Mary J. Drexel Home. 6112 Germantown Ave.

1883. Baum, Charles, A.M., M.D., Ph.D. 1828 Wallace St.

1922. Bazett, Henry Cuthbert, M.A., M.D. (Oxon), F.R.C.S. (England), Professor of Physiology, University of Pennsylvania. Narbeth, Pa.

1908. Beardsley, Edward J. G., M.D., L.R.C.P. (Lond.), Assistant Professor of Medicine in the Jefferson Medical College; Chief Clinical Assistant in the Out-patient Medical Department of the Jefferson Medical College Hospital; Assistant Physician to the Jefferson Hospital. 258 S. Sixteenth St.

*1916. Bell, William Hemphill, M.D., Captain, Medical Corps, U. S. Navy, Medical Aide to Commander-in-Chief and Fleet Surgeon, Battle Fleet, U. S. Fleet. Flagship, Battle Fleet, U. S. Fleet, care Postmaster, San Francisco, Cal.

ELECTED

*1896. Beyea, Henry D., M.D. Ware Neck, Va.

*1903. Biggs, Montgomery H., M.D., Surgeon to the Rutherford Hospital; Chief Surgeon of the Carolina, Churchfield and Ohio Railway. Rutherfordton, N. C.

1918. Billings, Arthur E., M.D. 1703 Spruce St.

1917. Birdsall, Joseph C., A.B., A.M., M.D., Urologist, Polyclinic Section of the Medico-Chirurgical College and Hospital Graduate School of Medicine University of Pennsylvania; Assistant in Genito-urinary Dispensary, Presbyterian Hospital; Instructor in Surgery, University of Pennsylvania. 4610 Spruce St.

1908. Bland, Pascal Brooke, M.D., Chief Clinical Assistant in the Gynecological Department of the Jefferson Medical College Hospital; Instructor in Gynecology in the Jefferson Medical College; Gynecologist to St. Joseph's Hospital; Assistant Gynecologist to the Philadelphia General Hospital. 1621 Spruce St.

1917. Block, Frank B., A.B., M.D., Surgeon to the Jewish Hospital; Instructor in Gynecology in the University of Pennsylvania. 2035 Chestnut St.

1894. Bochroch, Max H., M.D., Neurologist to the St. Joseph's and Jewish Hospitals; Physician to the Psychopathic Wards of the Philadelphia General Hospital. 1539 Pine St.

1896. Boger, John A., A.M., M.D., Surgeon to St. Mary's Hospital; Surgeon to the Stetson Hospital; Surgeon to the Dispensary of the Episcopal Hospital. 2213 N. Broad St.

1911. Bonney, Charles W., A.B., M.D., Associate in Topographic and Applied Anatomy in the Jefferson Medical College. 1117 Spruce St.

1921. Borzell, Francis Frank, M.D., Roentgenologist, Frankford Hospital; Chief Clinical Assistant, Roentgen Department, Jefferson Medical College; *X*-Ray Consultant, State Hospital for the Insane, Norristown, Pa. 1933 Chestnut St.

1913. Boston, L. Napoleon, A.M., M.D., Professor of Physical Diagnosis in the Medico-Chirurgical College; Physician to the Philadelphia General Hospital; Pathologist to the Frankford Hospital. 2024 Chestnut St.

1919. Bowen, David Ralph, M.D., Radiologist to the Pennsylvania Hospital; Assistant Professor in Radiology, Graduate School of Medicine, University of Pennsylvania. 82 W. Lacrosse Ave., Lansdowne, Pa.

ELECTED

1891. Boyd, George M., M.D., Professor of Obstetrics, Graduate School of Medicine, University of Pennsylvania; Obstetrician and Gynecologist to the Philadelphia Lying-in Charity; Obstetrician and Gynecologist to the Medico-Chirurgical Hospital. 1909 Spruce St.

1907. Boyer, Henry Percival, M.D., Neurologist to the Stetson Hospital; Physician to the Philadelphia Home for Incurables; Assistant Physican to the Orthopædic Hospital and Infirmary for Nervous Diseases. 4602 Baltimore Ave.

1907. Bradley, William N., Ph.G., M.D., Visiting Pediatrist to Howard Hospital; Visiting Pediatrist to Philadelphia General Hospital; Instructor in Pediatrics in the University of Pennsylvania; Associate in Pediatrics, Graduate School of Medicine, University of Pennsylvania. 1725 Pine St.

1921. Bransfield, John W., M.D., Visiting Surgeon to St. Agnes and St. Vincent's Hospital. 2025 Walnut St.

1903. Branson, Thomas F., M.D., Attending Physician to the Bryn Mawr Hospital. Rosemont, Pa.

1891. Brinton, Lewis, M.D., Physician-in-Chief to the American Hospital for Diseases of the Stomach. 1301 Medical Arts Bldg., Sixteenth and Walnut Sts.

1900. Brinton, Ward, A.M., M.D., Visiting Physician to the Tuberculosis Department of the Philadelphia General Hospital; Visiting Physician, Eagleville Sanatorium; Clinical Professor of Medicine, Woman's Medical College; Instructor in Medicine, University of Pennsylvania. 1423 Spruce St.

1917. Bromer, Ralph S., A.B. (Yale University), M.D., Roentgenologist to the Episcopal and the Orthopædic Hospitals. 4429 Walnut St.

*1907. Brooks, Macy, A.B. (Princeton), M.D., Care Morgan, Harjes & Co., Paris, France.

1919. Brown, H. MacVeagh, M.D., Associate Physician, Presbyterian Hospital. 4608 Baltimore Ave.

1919. Browh, Henry P., Jr., M.D., Assistant Surgeon, Presbyterian and Pennsylvania Hospitals; Dispensary Surgeon, Children's Hospital. 2134 Spruce St.

1916. Brown, Samuel Horton, M.D. 1901 Mt. Vernon St.

1887. Brubaker, Albert P., A.M., M.D., Professor of Physiology and Medical Jurisprudence in the Jefferson Medical College. 3426 Powelton Ave.

ELECTED

1916. Buckley, Albert Coulson, M.D., Medical Superintendent, Friends' Hospital, Frankford; Associate Professor of Psychiatry, Graduate School of Medicine, University of Pennsylvania; Alienist to the Orthopædic Hospital and Infirmary for Nervous Diseases. Frankford, Phila.

1906. Burns, Stillwell C., M.D., Associate Professor of Surgery in the Graduate School of Medicine, University of Pennsylvanian. 1925 Spring Garden St.

1892. Burr, Charles W., M.D., Professor of Mental Diseases in the University of Pennsylvania; Neurologist to the Philadelphia General Hospital. 1918 Spruce St.

1906. Butler, Ralph, M.D., Professor of Diseases of the Nose and Throat in the Philadelphia Polyclinic and the College for Graduates in Medicine; Chief of the Dispensary for Diseases of the Ear at the University Hospital; Assistant Professor of Otology in the University of Pennsylvania; Laryngologist and Aurist to the Lankenau Hospital. 2007 Chestnut St.

*1908. Cadbury, William W., A.M., M.D., Canton Christian College, Canton, China.

†1907. Cadwalader, Williams B., M.D., Assistant Professor of Neurology, School of Medicine, University of Pennsylvania; Neurologist to the Presbyterian Hospital; Consulting Neurologist to the Bryn Mawr Hospital. 1206 Medical Arts Building.

1905. Carmany, Harry S., M.D., Surgeon to St. Timothy's Hospital, Roxborough; Associate Surgeon of the Episcopal Hospital; Surgeon to the Dispensary of the Episcopal Hospital. 366 Green Lane, Roxborough.

1910. Carnett, John Berton, M.D., Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Associate in Surgery, Medical Department, University of Pennsylvania; Surgeon to Philadelphia General Hospital; Chief Surgeon to the American Stomach Hospital. 123 S. Twentieth St.

1905. Carpenter, Herbert B., M.D. 1805 Spruce St.

1895. Carpenter, John T., M.D., Attending Ophthalmologist to the Bryn Mawr Hospital. 2030 Chestnut St.

1917. Carson, John B., M.D., Physician to Episcopal Hospital; Assistant Physician, Pennsylvania Hospital. 1802 Pine St.

ELECTED

1922. Case, Eugene A., M.D., Associate Professor of Pathology, University of Pennsylvania; Assistant Pathologist, Philadelphia General Hospital. Lansdowne, Pa.

1900. Chance, Burton, M.D., Attending Surgeon to the Wills Eye Hospital; Consulting Ophthalmologist Eastern Pennsylvania Institution for the Feeble-minded and Epileptics; Ophthalmic Surgeon to the Pennsylvania Railroad Company. 1305 Spruce St.

1897. Cheston, Radcliffe, M.D., Visiting Physician to the Chestnut Hill Hospital; Consulting Physician to the Germantown Hospital, and to the Pennsylvania Institution for the Deaf and Dumb. Chestnut Hill.

1903. Chrystie, Walter, M.D. One of the Senior Physicians to Bryn Mawr Hospital. Bryn Mawr, Pa.

1899. Clark, John G., M.D., Professor of Gynecology in the University of Pennsylvania; Gynecologist-in-Chief to the University Hospital. 2017 Walnut St.

1896. Cleveland, Arthur H., M.D., Clinical Professor of Laryngology in the Medico-Chirurgical College; Laryngologist to the Medico-Chirurgical Hospital; Laryngologist and Aurist to the Presbyterian Hospital, and to Pennsylvania Institution for Deaf and Dumb. 317 S. Fifteenth St.

1910. Cloud, J. Howard, M.D., Assistant Physician to the Bryn Mawr Hospital; Attending Physician to the Children's House of Bryn Mawr Hospital. 11 W. Montgomery Ave., Ardmore, Pa.

1903. Coates, George Morrison, A.B., M.D., Professor of Otology, Graduate School of Medicine, University of Pennsylvania; Associate Surgeon, Ear, Throat, and Nose, Pennsylvania Hospital; Consulting Laryngologist to the Philadelphia Orphanage and to the Sharon Hospital, Sharon, Conn. 1811 Spruce St.

1908. Codman, Charles A. E., M.D., Physician to the American Oncologic Hospital. 4116 Spruce St.

1922. Cohen, Leon Solis, A.B., M.D., Clinical Assistant of Roentgenology, Jefferson Medical College. 1923 Spruce St.

1907. Cohen, Myer Solis, A.B., M.D., Pediatrist to the Jewish Hospital and to the Eagleville Sanatorium; Director of the Jules E. Mastbaum Research Laboratory of the Jewish Hospital; Assistant Professor in Medicine, Graduate School of Medicine, University of Pennsylvania. 1833 Pine St.

ELECTED

1888. Cohen, Solomon Solis, M.D., Professor of Clinical Medicine in the Jefferson Medical College; Physician to the Jefferson Medical College Hospital, to the Philadelphia General Hospital, to the Jewish Hospital, and to the Rush Hospital. 1906 Walnut St.

1920. Cole, Charles J., A.B., M.D., Visiting Physician, Philadelphia Hospital for Contagious Diseases; Assistant Pediatrist, Polyclinic Hospital; Physician to Out-patient Department, Mary Drexel Home; Assistant Physician to Out-patient Department, Children's Hospital, University Hospital. 1521 Spruce St.

1898. Coles, Stricker, M.D., Assistant Professor of Obstetrics in the Jefferson Medical College; Assistant Obstetrician to the Jefferson and the Philadelphia General Hospitals; Visiting Physician to the Philadelphia Lying-in-Charity Hospital. 2103 Walnut St.

*1901. Coley, Thomas Luther, A.B., M.D., Major Medical Corps, U. S. Army, Fitzsimmons General Hospital, Denver, Colo.

1903. Coplin, W. M. L., M.D., Professor of Pathology in the Jefferson Medical College; Pathologist to and Director of the Laboratories of the Jefferson Medical College Hospital; Pathologist to the Philadelphia General Hospital and to the Friends' Asylum for the Insane, Frankford; Bacteriologist to the Pennsylvania State Board of Health. 606 S. Forty-eighth St.

1912. Copp, Owen, A.B., M.D., Consultant for the Future Development of the Pennsylvania Hospital, Pennsylvania Hospital for the Insane, Forty-fourth and Market Sts.

1911. Cornell, Walter Stewart, A.B., M.D., Director of Medical Inspection of Public Schools of the City of Philadelphia; Chief of Medical Staff of the House of Detention; Lecturer on Osteology in the University of Pennsylvania. 729 City Hall.

1914. Corson, Edward Foulke, M.D., Assistant Dermatologist, Jefferson Hospital and Children's Hospital Dispensary; Chief Clinical Assistant in the Skin Dispensary, Jefferson Hospital. 2039 Chestnut St.

1907. Council, Malcolm S., M.D., Attending Physician to the Bryn Mawr Hospital; Attending Physician to the Cathcart Home at Devon. Bryn Mawr, Pa.

ELECTED

1904. Craig, Frank A., M.D., Instructor in Medicine in the University of Pennsylvania; Visiting Physician to the Henry Phipps Institute, University of Pennsylvania; Visiting Physician to the White Haven Sanatorium; Tuberculosis Consultant to the Presbyterian Hospital. 2011 Pine St.

1907. Crampton, George S., M.D., Attending Surgeon to the Eye Department of the Pennsylvania Hospital and the Philadelphia Hospital for Contagious Diseases; Assistant Surgeon to the Wills Hospital; Lecturer on Physiologic Optics in the Philadelphia Polyclinic and School for Graduates in Medicine; Ophthalmologist to the Philadelphia Orphanage. 1700 Walnut St.

1920. Creighton, William J., B.A., M.D., Assistant Ophthalmic Surgeon, Germantown Hospital and Dispensary; Assistant Dispensary Surgeon, Department Ophthalmology, University Hospital; Instructor in Ophthalmology, University of Pennsylvania Medical School. 1905 Chestnut St.

1920. Cross, George Howard, M.D., Ophthalmologist to the Chester Hospital. Chester, Pa.

1917. Cross, Sumner H., A.B., M.D., Physician to the Abington Memorial Hospital, Abington, Pa. 412 York Road, Jenkintown, Pa.

1921. Crossan, Edward T., M.D., 2132 Spruce St.

1904. Cruice, John M., M.D., Physician to the Henry Phipps Institute of the University of Pennsylvania; Physician to the Medical Dispensary of St. Agnes' Hospital; Instructor in Medicine in the University of Pennsylvania. 1932 Spruce St.

*1910. Cummins, W. Taylor, M.D., Pathologist to the Southern Pacific Hospital; Director of the Mary W. Harriman Research Laboratory, San Francisco, Cal.

1902. Currie, Charles A., M.D., Physician to the Germantown Hospital. West Walnut Lane, Germantown.

1896. Da Costa, John Chalmers, M.D., Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to the Philadelphia General and St. Joseph's Hospitals. 2045 Walnut St.

1887. Daland, Judson, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania. 317 S. Eighteenth St.

ELECTED

°1859. Darrach, James, M.D., Consulting Surgeon to the Germantown Hospital. Preston Apartments, Atlantic City, N. J.

1919. Davies, John R., Jr., M.D., Chief to the Out-patient Nose, Throat and Ear Department of the Pennsylvania, Bryn Mawr and Chestnut Hill Hospitals. 302 S. Nineteenth St.

1896. Davis, Charles N., M.D., Dermatologist to the Pennsylvania Hospital; Consulting Dermatologist to St. Agnes' Hospital; Assistant Physician to the Dispensary for Skin Diseases in the Howard Hospital. 1931 Spruce St.

1888. Davis, Edward P., A.M., M.D., Professor of Obstetrics in the Jefferson Medical College; Obstetrician to the Jefferson Hospital; Obstetrician and Gynecologist to the Philadelphia General Hospital; Consultant to the Preston Retreat. 250 S. Twenty-first St.

1916. Davis, Warren B., M.D., Oral Surgeon, Philadelphia General Hospital; Assistant Rhinologist and Otologist St. Agnes' Hospital; Assistant Demonstrator of Anatomy Jefferson Medical College; Clinical Assistant in Surgical Dispensary Jefferson Hospital. 135 S. Eighteenth St.

1900. Davisson, Alex. Heron, M.D. 4514 Springfield Ave.

1894. Deaver, Harry C., M.D., Professor of Surgery in the Woman's Medical College of Pennsylvania; Surgeon to the Episcopal Hospital, and to the Children's Hospital of the Mary J. Drexel Home; Surgeon-in-Chief to the Kensington Hospital for Women. 1701 Spruce St.

1887. Deaver, John B., M.D., D.Sc., LL.D., John Rea Barton Professor of Surgery, University of Pennsylvania; Visiting Surgeon, Hospital of the University of Pennsylvania; Surgeon-in-Chief to the Lankenau Hospital. 1634 Walnut Street.

1902. Dehoney, Howard, M.D. 240 S. Thirteenth St.

1885. Dercum, Francis X., A.M., M.D., Ph.D., Professor of Nervous and Mental Diseases in the Jefferson Medical College; Consulting Neurologist to the Philadelphia General Hospital; Foreign Corresponding Member of the Neurological Society of Paris, and Corresponding Member of the Psychiatric and Neurological Society of Vienna. 1719 Walnut St.

1908. Despard, Duncan L., M.D., Surgeon to the Abington Memorial Hospital; Assistant Surgeon to the Jefferson Medical College Hospital; Demonstrator of Clinical Surgery in the Jefferson Medical College; Associate in Gynæcology in the Philadelphia Polyclinic Hospital. 256 S. Twenty-first St.

ELECTED

1912. Dewey, J. Hiland, Ph.B., M.D., Assistant Surgeon to Wills Eye Hospital; Ophthalmic Surgeon to St. Francis' Hospital, Trenton, N. J. 1436 Diamond St.

*1911. Dickson, Frank D., M.D. 405 Waldheim Bldg., Kansas City, Mo.

1908. Dillard, Henry K., Jr., M.D., Physician to the Out-patient Department of the Pennsylvania Hospital; Physician to the Dispensary of the Mary J. Drexel Home. 234 S. Twentieth St.

1920. Diven, John, A.B., M.D., Pediatrician to St. Christopher's Hospital and Babies' Hospital of Philadelphia. 2002 Spruce St.

1920. Doane, Joseph Chapman, M.D., Medical Director Philadelphia General Hospital. Superintendent, Bureau of Hospitals.

*1897. Dorland, W. A. Newman, A.M., M.D., Professor of Gynecology in the Post-graduate Medical School of Chicago; Professor of Obstetrics in the Chicago College of Medicine and Surgery; Visiting Obstetrician to Cook County Hospital. 25 E. Washington St., Chicago, Ill.

1907. Dorrance, George Morris, M.D., Surgeon to St. Agnes' Hospital; Demonstrator of Applied Anatomy in the Dental Department of the University of Pennsylvania. 2025 Walnut St.

1902. Downs, Robert N., Jr., M.D., Surgeon to the Dispensary of the Germantown Hospital. 6008 Greene St., Germantown.

1910. Drayton, William, Jr., M.D., Physician to the Philadelphia Hospital for Contagious Diseases; Physician to the Out-patient Department of the Pennsylvania Hospital; Physician to the Pennsylvania Institute for the Instruction of the Blind; Assistant Physician to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases. 1316 Locust St.

1911. Earnshaw, Henry Culp, M.S., M.D., Attending Physician to the Hospital of the Good Shepherd, Rosemont; Assistant Attending Physician to the Bryn Mawr Hospital; Attending Physician to the Bryn Mawr Children's Hospital; Pennsylvania Railroad Surgeon. Bryn Mawr, Pa.

*1887. Edwards, William A., M.D., Professor of Pediatrics in the Medical Department of the University of California. Fifth and Spring Sts., Los Angeles, Cal.

ELECTED

1911. Eliason, Eldridge E., B.A., M.D., Associate in Surgery in the University of Pennsylvania; Surgeon to the Howard Hospital; Assistant Surgeon to the University of Pennsylvania Hospital, the Philadelphia General Hospital and the American Stomach Hospital. 330 S. Sixteenth St.

1904. Elmer, Walter G., B.S., M.D., Associate Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Associate Orthopædic Surgeon to the Polyclinic Hospital; Orthopædic Surgeon to the Jewish Hospital and to the Philadelphia General Hospital. 1801 Pine St.

1896. Ely, Thomas C., A.M., M.D. 3912 Chestnut St.

1901. Erck, Theodore A., M.D. 251 S. Thirteenth St.

1893. Eshner, Augustus A., M.D., Consulting Physician to Mercy Hospital. 1019 Spruce St.

*1905. Evans, Joseph S., Jr., A.B., M.D., Professor of Clinical Medicine in the University of Wisconsin; Consulting Physician, Madison General Hospital. 524 N. Francis St., Madison, Wis.

1905. Evans, William, M.D. 4007 Chestnut St.

1912. Eves, Curtis C., M.D., Aural and Laryngeal Surgeon to the Episcopal Hospital; Assistant in the Out-patient Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Demonstrator of Operative Surgery of the Ear, Nose, and Throat in the Philadelphia Polyclinic. 247 S. Seventeenth St.

1894. Faries, Randolph, M.D. 2007 Walnut St.

1922. Farley, David L., B.S., M.D., Instructor in Medicine, University of Pennsylvania; Assistant Physician, Pennsylvania Hospital. 1906 Pine St.

†1903. Farr, Clifford B., A.M., M.D., Director of Laboratories, Pennsylvania Hospital, Department for Mental and Nervous Diseases. Bryn Mawr, Pa.

1893. Farr, William W., M.D., Physician to the Leamy Home. 20 W. Ashmead Place, Chestnut Hill.

1884. Fenton, Thomas H., M.D., Ophthalmic Surgeon to St. Vincent's Home, the Baptist Home and the Widener Home for Crippled Children. 1319 Spruce Street.

1907. Fetterolf, George, A.B., M.D., Sc.D., Assistant Laryngologist, University Hospital; Assistant Professor of Anatomy, University of Pennsylvania; Consulting Laryngologist,

ELECTED

Kensington Hospital and Dispensary for Tuberculosis; Consulting Laryngologist, Eastern Pennsylvania Institute for the Feeble Minded and Epileptic. 2010 Spruce St.

1907. Fife, Charles A., A.B., M.D., Associate in Pediatrics in the University of Pennsylvania; Pediatrist to the Presbyterian Hospital; Physician to the St. Christopher's Hospital for Children; Assistant Physician to the Philadelphia General Hospital. 2104 Spruce St.

1884. Fisher, Henry M., M.D. 1027 Pine St.

1910. Fisher, John Monroe, M.D., Associate Professor of Gynecology in the Jefferson Medical College; Gynecologist to the Philadelphia, St. Agnes', and Pottstown Hospitals; Assistant Gynecologist to the Jefferson Medical College Hospital. 345 S. Nineteenth St.

1888. Flick, Lawrence F., M.D. 736 Pine St.

1916. Forst, John R., M.D. 166 W. Coulter St., Germantown.

1908. Foulkrod, Collin, M.D., Obstetrician to the Presbyterian Hospital; Assistant Demonstrator of Obstetrics in Jefferson Medical College. 3910 Chestnut St.

1908. Fox, Herbert, M.D., Director of the William Pepper Laboratory of Clinical Medicine, University of Pennsylvania; Pathologist to the Laboratory of Comparative Pathology of the Zoölogical Society of Philadelphia; Pathologist to the Rush Hospital; Pathologist to the Children's Hospital. 3902 Locust St.

†1885. Fox, Joseph M., M.D. Torresdale, Pa.

1906. Fraley, Frederick, Jr., A.B., M.D. Overbrook, Pa.

1903. Francine, Albert Philip, A.B., M.A., M.D., Chief of the Division of Tuberculosis, State Department of Health. 264 S. Twenty-first St.

1897. Frazier, Charles H., A.B., M.D., Sc.D., John Rhea Barton Professor of Surgery, University of Pennsylvania; Surgeon-in-Chief to the University Hospital. 3600 Walnut St.

1916. Funk, Elmer Hendricks, M.D., Assistant Professor of Medicine in the Jefferson Medical College; Medical Director and Physician-in-Charge of the Department for Diseases of the Chest of Jefferson Hospital; Assistant Physician to the Pennsylvania Hospital; Visiting Physician to the White Haven Sanatorium. 1318 Spruce St.

1910. Furbush, Charles Lincoln, M.D., Director of Public Health, Philadelphia. 4300 Spruce St.

ELECTED

1899. Gamble, Robert, G. M.D., one of the Attending Physicians to the Bryn Mawr Hospital. Haverford, Pa.

1912. Gaskill, Henry Kennedy, M.D., Assistant Professor of Dermatology in the Jefferson Medical College; Attending Dermatologist to the Philadelphia General Hospital. N. E. Cor. 16th and Spruce Sts.

1917. Gerhard, Arthur Howell, M.D. 726 Richmond St.

1902. Ghriskey, Albert A., M.D. 3936 Walnut St.

1899. Gibbon, John H., M.D., Professor of Surgery in the Jefferson Medical College; Surgeon to the Pennsylvania Hospital and Consulting Surgeon to the Bryn Mawr Hospital. 1608 Spruce St.

1920. Gill, A. Bruce, A.B., M.D., Professor of Orthopædic Surgery, University of Pennsylvania; Surgeon to the Orthopædic Hospital; Orthopædic Surgeon to the Episcopal and Presbyterian Hospitals; Chief Surgeon to the Widener Memorial Industrial Training School for Crippled Children. The Lenox, 13th and Spruce Sts.

*1913. Ginsburg, Nathaniel, M.D. 10 Peterboro Ave., Detroit, Mich.

1897. Girvin, John H., M.D., Gynecologist to the Presbyterian Hospital; Associate Professor of Gynecology Graduate School of Medicine, University of Pennsylvania. 2120 Walnut St.

1920. Githens, Thomas Stotesbury, M.D. Hamilton Court, 39th and Chestnut Sts.

1906. Gittings, J. Claxton, M.D., Professor of Pediatrics, Graduate School of Medicine, University of Pennsylvania; Associate in Pediatrics in the University of Pennsylvania, School of Medicine; Visiting Physician to the Children's Hospital of Philadelphia; Assistant Pediatric Physician, University Hospital. 1828 Pine St.

1905. Given, Ellis E. W., M.D., Surgeon to the Philadelphia Freemasons Memorial Hospital of the Masonic Home, Elizabethtown, Pa.; Surgeon to the Dispensary of the Episcopal Hospital. 2714 Columbia Ave.

1894. Gleason, E. B., S.B., M.D., LL.D., Professor of Otology in the Medico-Chirurgical College. 2033 Chestnut St.

1906. Goepp, R. Max, M.D., Professor of Medicine, Graduate School of Medicine, University of Pennsylvania. 1814 Spruce St.

ELECTED

1906. Goldberg, Harold G., M.D., Ophthalmic Surgeon to the Episcopal Hospital, Kensington Hospital for Women and Baltimore and Ohio Railroad. 1925 Chestnut St.

1908. Goodman, Edward H., M.D., Associate in Medicine in the University of Pennsylvania; Consultant to the Medical Dispensary of the University Hospital; Assistant Physician to the University Hospital; Assistant Physician to the Philadelphia General Hospital; Physician to the Presbyterian Hospital. 248 S. Twenty-first St.

1905. Gordon, Alfred, M.D., Neurologist to the Mt. Sinai, the Northwestern General, and the Douglass Memorial Hospitals. 1812 Spruce St.

1894. Graham, Edwin E., M.D., Professor of Pediatrics in the Jefferson Medical College; Pediatrist to the Jefferson and the Philadelphia General Hospitals; Physician to the Franklin Reformatory Home. 1713 Spruce St.

1904. Grayson, Charles P., M.D., Professor of Laryngology and Rhinology in the University of Pennsylvania; Physician-in-Charge of the Throat and Nose Department of the University Hospital; Otolaryngologist to the Philadelphia General Hospital. 262 S. Fifteenth St.

1910. Greenman, Milton J., M.D., Sc.D., Director of the Wistar Institute of Anatomy and Biology. Wistar Institute of Anatomy and Biology, Thirty-sixth St. and Woodland Ave.

1883. Griffith, J. P. Crozer, A.B., M.D., Ph.D., Professor of Pediatrics in the University of Pennsylvania; Corresponding Member of the Société de Pédiatrie de Paris; Physician to the Children's Hospital of Philadelphia. 1810 Spruce St.

1912. Griscom, J. Milton, B.S., M.D., Assistant Surgeon to the Wills Eye Hospital. 1925 Chestnut St.

1911. Gummey, Frank Bird, M.D., Visiting Physician to the Germantown Hospital and Dispensary; Visiting Physician to the Midnight Mission. 5418 Greene St., Germantown.

*1902. Gwyn, Norman B., M.D., Clinician in Medicine, Toronto General Hospital; Clinician in Medicine, Medical Faculty University of Toronto School. 48 Bloor St., E., Toronto, Canada.

1894. Hamill, Samuel McC., M.D., Professor of Diseases of Children in the Philadelphia Polyclinic and College for Graduates in Medicine; Pediatrist to the Presbyterian Hospital; Pediatrist to St. Vincent's Home. 1822 Spruce St.

ELECTED

1897. Hand, Alfred, Jr., M.D., Visiting Physician to the Children's Hospital, to the Children's Hospital of the Mary J. Drexel Home, and to the Methodist Hospital. 1724 Pine St.

1886. Hansell, Howard F., M.D., Professor of Ophthalmology in the Jefferson Medical College; Ophthalmic Surgeon to the Philadelphia General Hospital and to the Jefferson Medical College Hospital; Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic. N. E. Cor. 17th and Walnut Sts.

1889. Hare, Hobart A., LL.D., M.D., Professor of Therapeutics, Materia Medica, and Diagnosis in the Jefferson Medical College. 1801 Spruce St.

1903. Hart, Charles D., A.M., M.D., Inspector and Secretary of the Eastern State Penitentiary; National Executive Committee and Chairman of the Philadelphia Committee, Boy Scouts of America. Chestnut Hill.

1885. Harte, Richard H., M.D., (Hon.) F. R. C. S. Ireland, Adjunct Professor of Surgery in the University of Pennsylvania; Surgeon to the Pennsylvania and the Orthopædic Hospitals; Consulting Surgeon to St. Mary's, St. Timothy's, and the Bryn Mawr Hospitals. 1503 Spruce St.

1888. Hartzell, Milton B., A.M., M.D., LL.D., Professor of Dermatology in the University of Pennsylvania. 3644 Chestnut St.

1907. Hatfield, Charles James, A.B (Princeton), M.D., Executive Director of the Henry Phipps Institute for the Study, Treatment, and Prevention of Tuberculosis; Visiting Physician to the White Haven Sanatorium. Phipps Institute, 7th and Lombard Sts.

1872. Hays, I. Minis, M.D. 266 S. Twenty-first St.

1911. Heed, Charles R., M.D., Ophthalmologist to Girard College; Assistant Ophthalmologist to the Jefferson Medical College Hospital. 1205 Spruce St.

1908. Heineberg, Alfred, P.D., M.D., Associate in Gynecology in the Jefferson Medical College; Assistant Gynecologist to St. Agnes' Hospital. 1923 Spruce St.

1901. Heisler, John C., M.D., Professor of Anatomy in the Medico-Chirurgical College. 3829 Walnut St.

1903. Henry, J. Norman, M.D., Physician to the Pennsylvania Hospital; Clinical Professor of Medicine in the Woman's

ELECTED

Medical College of Pennsylvania; Assistant Physician to the Philadelphia General Hospital. 1906 Spruce St.

1891. Hewson, Addinell, A.B., A.M., M.D., Professor of Anatomy in the Philadelphia Polyclinic and College for Graduates in Medicine; Professor of Anatomy and Histology in the Temple University; Surgeon to St. Timothy's Hospital, Roxborough. 2120 Spruce St.

1909. Higbee, William S., M.D., President of the Pennsylvania State Board of Examiners for Registration of Nurses. 930 S. Farragut Terrace.

1897. Hinkle, William M., M.D., Lecturer on the Anatomy and Physiology of the Vocal Organs in the National School of Elocution and Oratory. 1323 N. Thirteenth St.

*1892. Hinsdale, Guy, A.M., M.D. Hot Springs, Virginia.

*1888. Hirsh, A. Bern, M.D., Chief of Physiotherapy, United States Veteran's Bureau, District No. 2. 71 West 94th St., New York City.

1888. Hirst, Barton Cooke, A.B., M.D., LL.D., Professor of Obstetrics in the University of Pennsylvania; Gynecologist to the Philadelphia General and the Howard Hospitals. 1821 Spruce Street.

1903. Hirst, John Cooke, M.D., Associate in Obstetrics, University of Pennsylvania; Obstetrician to St. Agnes' Hospital; Gynecologist and Obstetrician to the Philadelphia General Hospital; Gynecologist to Mt. Sinai Hospital. 1823 Pine St.

*1908. Hitchens, Arthur Parker, M.D., Instructor in Bacteriology, Army Medical School; Special Lecturer, Infection and Immunity, Graduate School, Department of Agriculture; Advisory Professor in Bacteriology, American University. Washington, D. C.

1905. Hodge, Edward Blanchard, A.B., M.D., Surgeon to the Presbyterian and the Children's Hospitals; Associate Surgeon to the Pennsylvania Hospital; Associate Surgeon to the Widener Memorial Training School. 2019 Spruce St.

1913. Hoffman, Clarence, M.D., 1621 Pine St.

1906. Holloway, Thomas B., M.S., M.D., Vice-Dean for and Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania, Instructor in Ophthalmology in the University of Pennsylvania; Attending Surgeon to the Wills Hospital; Ophthalmologist to the Pennsylvania Institution for the Instruction of the Blind at Overbrook. 1819 Chestnut St.

ELECTED

1914. Hooker, Richard S., M.D. 2147 N. Howard St.

1919. Hopkins, Arthur H., B.S. (Haverford), M.D., Associate in Medicine and Instructor in Practical Therapeutics, University of Pennsylvania; Physician to the Protestant Episcopal Hospital; Consulting Physician to the Chester County Hospital, West Chester, Pa. 1726 Pine St.

1908. Hoyt, Daniel M., M.D., Assistant Visiting Physician to the Philadelphia General Hospital. The Tracy, 36th and Chestnut Sts.

*1912. Huber, G. Carl, M.D., Professor of Anatomy and Director of the Anatomic Laboratories in the University of Michigan. 1330 Hill St., Ann Arbor, Mich.

1892. Hughes, William E., M.D., Visiting Physician to the Philadelphia General Hospital; Consulting Physician to the Presbyterian Hospital. 3945 Chestnut St.

1912. Hunter, John W., B.S., M.D. 4715 Chester Ave.

1921. Hunter, Robert J., M.D., Laryngologist Philadelphia General Hospital; Chief of Dispensary and Assistant Laryngologist and Aurist, Presbyterian and Howard Hospitals; Instructor in Otology, University of Pennsylvania, Graduate School. 928 N. Sixty-third St.

1898. Hutchinson, James P., M.D., Surgeon to the Pennsylvania, the Methodist, the Children's, St. Timothy's, and the Bryn Mawr Hospitals; Adjunct Professor of Surgery in the University of Pennsylvania. 133 S. Twenty-second St.

°1871. Ingham, James V., M.D. 1811 Walnut St.

1921. Ivy, Robert H., D.D.S., M.D., Professor of Clinical Maxillo-Facial Surgery, University of Pennsylvania; Oral Surgeon to the Hospitals of the Graduate School of Medicine, University of Pennsylvania and to the Philadelphia General Hospital; Consultant in Maxillo-Facial Surgery, Walter Reed General Hospital, Washington, D. C. 1503 Medical Arts Building.

1917. Jackson, Chevalier, M.D., Sc.D., Professor of Laryngology, Jefferson Medical College; Professor of Bronchoscopy and Esophagoscopy, Graduate School of Medicine, University of Pennsylvania. 128 S. Tenth St.

*1885. Jackson, Edward, A.M., M.D., Sc.D., Emeritus Professor of Ophthalmology in the University of Colorado; Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic. 217 Imperial Building, Denver, Col.

ELECTED

*1906. Jacobs, Francis Brinton, B.S., M.D., Assistant Surgeon to the Chester County Hospital. Whitford, Pa.

1922. Jameson, Howard Leon, M.D., Assistant Professor of Medicine, Graduate School of Medicine, University of Pennsylvania; Assistant Physician, Medico-Chirurgical and Polyclinic Hospitals. 2133 S. Sixteenth St.

1920. Janvier, G. Victor, M.D., Instructor in Obstetrics, University of Pennsylvania; Assistant Obstetrician to the Philadelphia General Hospital and the University of Pennsylvania Hospital; Associate in Gynecology at the American Stomach Hospital. Lansdowne, Pa.

1913. Jefferys, William Hamilton, A.B., A.M., M.D. New Street, Chestnut Hill.

1919. Jenks, Horace H., M.D. 918 Clinton St.

1898. Johnson, Russell H., A.B. (Princeton), M.D., Physician to the Pennsylvania Institution for the Deaf and Dumb. Chestnut Hill, Philadelphia.

1918. Jonas, Leon, M.D. 2253 N. 17th St.

1900. Jones, Charles James, A.M., M.D., LL.D., Ophthalmic Surgeon to St. Joseph's Hospital; Ophthalmic Surgeon to the House of the Good Shepherd, Germantown; Consulting Ophthalmologist to St. Vincent's Home. 256 S. Fifteenth St.

1913. Jones, John F. X., B.S., A.B., A.M., M.D., Instructor in Surgery in the Jefferson Medical College; Surgeon to St. Joseph's, the Misericordia and St. Agnes Hospitals. 103 S. 21st St.

1900. Jopson, John H., M.D., Professor of Surgery Graduate School of Medicine, University of Pennsylvania; Associate in Surgery in the University of Pennsylvania; Surgeon to the Presbyterian and the Children's Hospitals. 1824 Pine St.

1900. Judson, Charles F., A.B., M.D., Physician to Out-patient Department of the Lankenau Hospital and to the Southern Home for Children. 1005 Spruce St.

1902. Jump, Henry D., M.D., Assistant Physician to Philadelphia General Hospital; Physician to the Misericordia Hospital. 2019 Walnut St.

1886. Jurist, Louis, M.D. 1308 N. Broad St.

1903. Kalteyer, Frederick J., M.D., Demonstrator of Clinical Medicine in the Jefferson Medical College; Chief of the

ELECTED

Out-patient Department, Assistant Attending Physician, and Hematologist to the Jefferson Medical College Hospital; Pathologist to Philadelphia Lying-in Charity. 1530 Locust St.

*1910. Karsner, Howard T., M.D., Professor of Pathology in the Western Reserve University Medical School. Lakeside Hospital, Cleveland, Ohio.

1920. Keating, Peter McCall, M.D., Chief of Surgical Dispensary, St. Agnes Hospital; Assistant Attending Surgeon, Bryn Mawr Hospital; Assistant, Surgical Out-patient Department, Pennsylvania Hospital; Pathologist, Chester County Hospital. Wawa, Pa.

†1867. Keen, William W., M.D., LL.D., Sc.D. (Hon.) Ph.D. (Hon.), F.R.C.S. (Eng., Edin. and Ire.), Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Associé Etranger de l'Academie de Médecin, Paris; Honorary Member of the Société Belge de Chirurgie; Honorary Fellow Royal Society of Medicine, London, Honorary F.A.C.S. 1530 Spruce St.

1912. Keene, Floyd E., M.D., Instructor in Gynecology in the University of Pennsylvania; Assistant Gynecologist to the University Hospital; Gynecologist to the Chestnut Hill Hospital. Medical Arts Bldg.

1913. Kelly, Francis Joseph, M.D. 2035 Chestnut St.

*1887. Kelly, Howard A., A.B., M.D., LL.D. (Aberdeen, Wash. and Lee, and Univ. of Pa.), Professor of Gynecology in Johns Hopkins University and Gynecologist to the Johns Hopkins Hospital, Baltimore, Md.; Hon. Fellow of the Edinburgh Obstetrical Society, the Royal Academy of Medicine of Ireland, and of the Glasgow Obstetrical and Gynecological Society. 1418 Eutaw Place, Baltimore, Md.

1909. Kelly, James A., A.M., M.D., Visiting Surgeon to St. Mary's and St. Timothy's Hospitals; Associate in Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Assistant Visiting Surgeon to St. Joseph's Hospital. 1815 Spruce St.

1912. Kelly, Thomas C., A.M., M.D., Assistant Instructor of Medicine in the University of Pennsylvania; Pediatrician to St. Mary's Hospital; Physician to Out-patient Department of Germantown Hospital. 105 School Lane, Germantown.

1898. Kempton, Augustus F., M.D. 2118 Pine St.

1905. Kercher, Delno E., M.D. 1534 Pine St.

ELECTED

1921. Kern, Richard A., A.B., M.D., Associate in Medicine, University of Pennsylvania; Assistant Physician, University Hospital; Associate in Medicine, Graduate School of Medicine, University of Pennsylvania. 906 Medical Arts Building.

1920. Klauder, Joseph Victor, M.D., Associate Professor, Dermatology and Syphilology, Graduate School of Medicine, University of Pennsylvania; Professor of Dermatology, Woman's Medical College; Dermatologist, Misericordia, Woman's Medical College and American Stomach Hospitals; Assistant Dermatologist, Philadelphia General Hospital. 1807 Spruce St.

1920. Klein, Thomas, M.D., Associate Professor of Medicine, Graduate School, University of Pennsylvania; Assistant Physician, Presbyterian Hospital. 1717 Pine St.

1913. Klopp, Edward J., M.D., Instructor in Surgery in the Jefferson Medical College; Assistant Surgeon to the Germantown Hospital; Chief Clinical Assistant in the Surgical Department of the Jefferson Hospital; Assistant Surgeon to the Out-patient Department of the Pennsylvania Hospital 1611 Spruce St.

1895. Kneass, Samuel S., M.D., Associate in the William Pepper Laboratory of Clinical Medicine in the University of Pennsylvania. 1510 Walnut St.

1908. Knipe, Jay C., M.D., Ophthalmologist to the Jewish Hospital; Assistant Ophthalmologist to the Philadelphia General Hospital, and to the Mary J. Drexel Home; Chief of the Eye Clinic at the Jefferson Medical College Hospital; Demonstrator of Osteology and Syndesmology in the Jefferson Medical College. 2035 Chestnut St.

1919. Knipe, Norman Leslie, Ph.B. (Cornell); M.D., Instructor in Obstetrics, University of Pennsylvania; Assistant Obstetrician, University Hospital; Gynecologist, St. Mary's Hospital; Associate Gynecologist, American Stomach Hospital. 2018 Chestnut St.

1908. Knowles, Frank Crozer, M.D., Professor of Dermatology, Jefferson Medical College; Dermatologist to the Presbyterian and Children's Hospitals; Chief of Clinic, Pennsylvania Hospital. 2022 Spruce St.

1914. Kolmer, John A., M.D., Dr. P.H., M.Sc., Professor of Pathology and Bacteriology Graduate School of Medicine, University of Pennsylvania; Head of the Department of Pathology and Bacteriology in the Dermatological Research

ELECTED

Laboratories of Philadelphia; Consulting Pathologist to St. Vincent's and Misericordia Hospitals; Consulting Serologist to Memorial and Germantown Hospitals. Cynwyd, Pa.

1904. Krauss, Frederick, M.D., Ophthalmic Surgeon to the Episcopal Hospital; Ophthalmic Surgeon to St. Christopher's Hospital for Children; Laryngologist to the Abington Hospital. 1701 Chestnut St.

1914. Krumbhaar, Edward B., A.B., Ph.D., M.D., Director of Laboratories, Philadelphia General Hospital; Associate Professor of Pathology in the Graduate School of Medicine of the University of Pennsylvania. Box 4310, Chestnut Hill.

1900. Krusen, Wilmer, M.D., Professor of Gynecology in the Medical Department of Temple University; Chief Gynecologist to the Samaritan and the Garretson Hospitals; Consulting Gynecologist to the Charity and Mercy Hospitals. 127 N. Twentieth St.

*1909. Laird, J. Packard, M.D. 34 N. Bayshore Drive, Miami, Florida.

1904. Landis, Henry R. M., M.D., Director of the Clinical and Sociological Departments of the Henry Phipps Institute of the University of Pennsylvania; Assistant Professor in Medicine in the University of Pennsylvania; Visiting Physician to the White Haven Sanatorium. 1818 S. Rittenhouse Square.

1907. Langdon, H. Maxwell, M.D., Associate Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania; Instructor of Ophthalmology, Under-Graduate School, University of Pennsylvania; Ophthalmologist of the Presbyterian, Orthopædic and Children's Hospitals. 1530 Locust St.

1922. Lawrance, Stuart J., M.D., Obstetrician, St. Mary's Hospital. 1332 Spruce St.

1922. Leach, Wilmon W., M.D. 2118 Spruce St.

*1887. Leaman, Henry, M.D. Leaman Place, Pa.

1920. Leavitt, Frederick Headley, M.D. 1527 Pine St.

1904. Le Boutillier, Theodore, M.D., Professor of Pediatrics in the Woman's Medical College of Pennsylvania; Pediatrist to the Woman's College Hospital; Physician to the Philadelphia Hospital for Contagious Diseases. 2008 Walnut St.

ELECTED

1893. Le Conte, Robert G., A.B., M.D., Surgeon to the Pennsylvania Hospital; Consulting Surgeon to the Bryn Mawr and Germantown Hospitals. 2000 Spruce St.

1908. Lee, Walter Estell, M.D., Surgeon to the Germantown and Children's Hospitals; Assistant Surgeon to the Pennsylvania and Bryn Mawr Hospitals; Associate Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Consulting Surgeon, Henry Phipps Institute and Pennsylvania State Department of Health. 905 Pine St.

1903. Leffmann, Henry, A.M., M.D., D.D.S., Ph.D., Emeritus Professor of General Chemistry and Hygiene in the Woman's Medical College of Pennsylvania; Honorary Professor of Chemistry in the Wagner Free Institute of Science; Special Lecturer on Research, Philadelphia College of Pharmacy and Science. 1839 N. Seventeenth St.

1892. Leidy, Joseph, M.D., Officier d'instruction publique, France; Consulting Physician to the Pennsylvania Training School for Feeble-minded Children. 1319 Locust St.

1920. Leopold, Simon S., M.D. 2025 Spruce St.

1915. Lewis, Fielding O., M.D., Associate in Laryngology in the Jefferson Medical College Hospital; Operating Clinical Chief of the Laryngological Dispensary and Clinical Assistant of the Otological Dispensary of the Jefferson Medical College Hospital; Laryngologist of the Philadelphia General Hospital. 261 S. Seventeenth St.

1877. Lewis, Morris J., M.D., Attending Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases and Emeritus Physician to the Pennsylvania Hospital. 1316 Locust St

1911. Lewis, Paul A., M.D., Director of the Pathological Department of the Henry Phipps Institute of the University of Pennsylvania; Professor of Experimental Pathology in the University of Pennsylvania. Henry Phipps Institute. Seventh and Lombard Sts.

1904. Lindauer, Eugene, M.D., Instructor of Neurology in the Medico-Chirurgical Hospital; Associate in Clinical Medicine in the Philadelphia Polyclinic; Assistant Neurologist to the Philadelphia General Hospital. 2018 N. Thirty-second Street.

1886. Lloyd, J. Hendrie, A.M. (Princeton), M.D., Neurologist to the Philadelphia General Hospital, and to the Methodist Episcopal Hospital; Consulting Neurologist to the State

ELECTED

Asylum for the Chronic Insane at Wernersville, and to the Pennsylvania Training School for Feeble-minded Children at Elwyn. 4057 Spruce St.

1907. Lodholz, Edward, M.D., Demonstrator of Physiology in the University of Pennsylvania. 1106 S. Fifty-second St.

1893. Longaker, Daniel, M.D., Obstetrician to the Kensington Hospital for Women and Visiting Obstetrician to the Jewish Maternity Hospital. 1806 Spruce St.

1907. Loux, Hiram R., M.D., Professor of Genito-urinary Surgery in the Jefferson Medical College; Surgeon to the Philadelphia General Hospital. Medical Arts Building, Sixteenth and Walnut Sts.

1921. Lucke, Baldwin, Dr. P.H., M.D., Assistant Pathologist, University and Philadelphia General Hospitals. Assistant Professor of Pathology, Medical School, University of Pennsylvania.

1919. Lynch, Frank B., Jr., M.D., Pepper Laboratory, University of Pennsylvania.

1914. Lyon, B. B. Vincent, A.B. (Williams Coll.), M.D., (Johns Hopkins), Associate in Medicine Jefferson Medical College; Chief-of-Clinic, Gastro-Intestinal Department, Jefferson Hospital; Visiting Physician to Methodist Hospital. 328 S. Twenty-first St.

1900. McCarthy, Daniel J., M.D., Professor of Medical Jurisprudence (George B. Wood Foundation) in the University of Pennsylvania; Neurologist to the Philadelphia General and St. Agnes' Hospitals, and to the Henry Phipps Institute. 2025 Walnut St.

*1903. McConnell, Guthrie, M.D., Pathologist to the Cleveland City Hospital; Associate in Pathology, Western Reserve Medical School. 2601 Hampshire Road, Cleveland, Ohio.

1913. McCrae, Thomas, B.A., M.D., F.R.C.P. (Lond.), Professor of Medicine in the Jefferson Medical College; Physician to the Jefferson and Pennsylvania Hospitals. 1929 Spruce Street.

1895. McFarland, Joseph, M.D., Sc.D., Professor of Pathology and Bacteriology in the Medical Department of the University of Pennsylvania; Pathologist to the Philadelphia General Hospital. 442 W. Stafford St., Germantown.

1913. McGlinn, John A., M.S., M.D., Associate Professor of Gynecology, Graduate School of Medicine, University of Pennsylvania; Gynecologist to St. Agnes' Hospital; Gyne-

ELECTED

cologist, Philadelphia General Hospital. 1530 Locust St.

1905. McKenzie, R. Tait, M.D., LL.D., Professor of Physical Education and Director of the Department of Physical Education in the University of Pennsylvania. 2014 Pine St.

1916. McKnight, Howard A., A.B., M.D., Assistant Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Surgeon, St. Mary's Hospital; Chief Surgical Clinic, Polyclinic and Medico-Chirurgical Hospitals. 345 S. Nineteenth St.

1915. McLean, John D., M.D. 1538 S. Broad St.

*1900. McReynolds, Robert Phillips, M.D. 213 S. Broadway, Los Angeles, Cal.

1886. MacCoy, Alexander W., M.D., Consulting Laryngologist to the Bryn Mawr Hospital. Haverford Court, Haverford, Pa.

1910. Mackinney, William H., M.D., Assistant Surgeon to the Dispensary for Genito-urinary Diseases, University Hospital; Assistant in the Urological Dispensary of the Lankenau Hospital. 1701 Chestnut St.

1914. Maier, F. Hurst, M.D., Associate in Gynecology to the Jefferson Medical College; Gynecologist to St. Joseph's Hospital. 2019 Walnut St.

1913. Major, C. Percy, M.D., Physician to the Dispensary of the Germantown Hospital; Pediatrist to the Dispensary of the Germantown Hospital; Pediatrist to the Abington Memorial Hospital. Tenth and Oak Lane.

1913. Manges, Willis F., M.D., Roentgenologist to the Jefferson Hospital; Director of the Roentgen Ray Laboratory in the Philadelphia General Hospital. 235 S. Fifteenth St.

1898. Marshall, George Morley, M.D., Laryngologist to the Philadelphia General Hospital; Laryngologist and Otologist to St. Joseph's Hospital. 1819 Spruce St.

1889. Martin, Edward, M.D., Surgeon to the University, Howard, Philadelphia General, and Bryn Mawr Hospitals. 135 S. Eighteenth St.

*1911. Meigs, Edward Browning, A.B., M.D., Physiologist in the Dairy Division of the United States Department of Agriculture. 1445 Rhode Island Ave., N. W., Washington, D. C.

1914. Mencke, J. Bernhard, A.B., M.D., Assistant Surgeon to the Out-patient Department of the Lankenau Hospital; Assistant Surgeon to the Stetson Hospital. 1816 Spruce Street.

ELECTED

1914. Merrill, William Jackson, A.B., M.D., Professor of Orthopædic Surgery, Graduate School of Medicine, University of Pennsylvania; Orthopædic Surgeon to the Children's Hospital, Germantown Hospital, Children's Seashore House; Consulting Orthopædic Surgeon to the Howard Hospital and Glen Mills School. 2017 Spruce St.

*1894. Miller, D. J. Milton, M.D., Associate Physician to the Children's Hospital, Philadelphia; Pediatrist to the Bamberger Home for Invalid Children, Longport, N. J. N. W. Cor. Pacific and California Aves., Atlantic City, N. J.

1922. Miller, Edwin B., M.D., Assistant Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania; Associate in Ophthalmology, Temple University; Ophthalmologist, Roosevelt Hospital. 2008 Walnut St.

1910. Miller, Morris Booth, M.D., Professor of Surgery in the Philadelphia Polyclinic; Surgeon to the Douglass Memorial Hospital; Assistant Surgeon to the Philadelphia General Hospital. 2310 Pine St.

1921. Miller, T. Grier, A.B., M.D., Assistant Physician, University Hospital; Associate in Medicine, University of Pennsylvania. 110 S. Twentieth St.

1881. Mills, Charles K., M.D., LL.D., Emeritus Professor of Neurology in University of Pennsylvania; Neurologist to Philadelphia General Hospital; Consulting Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases. 1909 Chestnut Street.

1917. Mitchell, A. Graeme, M.D., Associate in Pediatrics, University of Pennsylvania; Assistant Pediatrist, Presbyterian Hospital; Clinical Assistant, Children's Hospital of Philadelphia; Physician to Dispensary Children's Hospital of Philadelphia. 1725 Pine St.

1904. Mitchell, Charles F., M.D., Surgeon to the Pennsylvania, Bryn Mawr, and Germantown Hospitals. 332 S. Fifteenth Street.

1921. Mohler, Henry K., P.D., M.D., Instructor in Medicine, Jefferson Medical College; Medical Director, Jefferson Hospital. 319 S. Sixteenth St.

*1908. Montgomery, Charles M., A.B., M.D., U.S.P.H.S. Hospital, Oteen, N. C.

1882. Montgomery, Edward E., A.M., M.D., LL.D., Gynecologist to the Jefferson Medical College Hospital and to St. Joseph's Hospital. 1426 Spruce St.

ELECTED

1918. Morgan, Arthur C., M.D., Associate Professor in Medicine Graduate School of Medicine, University of Pennsylvania; Visiting Physician to Tuberculosis Department, Philadelphia General Hospital; Physician-in-Chief to the Frankford Hospital. 3118 Diamond St.

1886. Morris, Caspar, M.D. 2050 Locust St.

1893. Morris, Elliston J., M.D., Physician to the Episcopal Hospital. 128 S. Eighteenth St.

1883. Morris, Henry, M.D., Emeritus Professor of Anatomy in the Woman's Medical College of Pennsylvania; Consulting Physician to St. Joseph's Hospital. 313 S. Sixteenth St.

°1856. Morris, J. Cheston, M.D. "Fernbank," West Chester, Pa.

1906. Morrison, William H., M.D. 8021 Frankford Ave.

1897. Morton, Samuel W., M.D. 2007 Chestnut St.

1905. Müller, George P., M.D., Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; Associate in Surgery in the Medical School, University of Pennsylvania; Surgeon to the University and Misericordia Hospitals; Consulting Surgeon to the Chester County Hospital. 1930 Spruce St.

1915. Musser, John H., Jr., B.S., M.D., Assistant Professor in Medicine in the University of Pennsylvania; Physician to the Philadelphia General Hospital; Physician-in-Charge, Medical Dispensary, University Hospital; Dispensary Chief and Assistant Physician in the Presbyterian Hospital. 262 S. Twenty-first St.

1905. Mutschler, Louis H., M.D., Surgeon to the Episcopal Hospital; Assistant Surgeon to the Orthopædic Hospital. 1625 Spruce St.

*1896. Myers, T. D., M.D. Hotel Cecil, 545 Post St., San Francisco, Cal.

1902. Nassau, Charles F., M.D., LL.D., Assistant Professor of Surgery in the Jefferson Medical College; Surgeon to St. Joseph's Hospital; Chief Surgeon to the Frankford Hospital; Surgeon to Mount Sinai Hospital. 1710 Locust St.

1886. Neff, Joseph S., A.M., M.D., LL.D., D.P.H., Narberth, Pa.

1887. Neilson, Thomas Rundle, A.M., M.D., Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Professor of Genito-urinary Surgery in the University of Pennsylvania. 1937 Chestnut St.

1905. Newcomet, William S., M.D. 3501 Baring St.

ELECTED

1905. Newlin, Arthur, B.S., M.D., Physician to the Pennsylvania Hospital; Physician to the Dispensary of the Children's Hospital; Assistant Physician to the Orthopædic Hospital. 1804 Pine St.

1899. Nicholson, William Rufus, A.B., M.D., Gynecologist to the Polyclinic and Methodist Episcopal Hospitals; Obstetrician to the Presbyterian Hospital; Professor of Gynecology, Graduate School of Medicine, University of Pennsylvania; Associate in Obstetrics in the University of Pennsylvania. 2023 Spruce St.

1889. Noble, Charles P., M.D. 1832 Spruce St.

1905. Norris, Charles C., M.D., Associate in Gynecology, University of Pennsylvania Medical School; Assistant Professor, Graduate School of Medicine, University of Pennsylvania; Assistant Gynecologist to the Hospital of the University of Pennsylvania; Gynecologist to the Children's Hospital, Philadelphia. Coronado, 22d and Chestnut Sts.

1905. Norris, George William, A.B., M.D., Professor of Clinical Medicine in the University of Pennsylvania; Physician to the Pennsylvania Hospital. 1820 S. Rittenhouse Sq.

*1901. Norris, Henry, M.D., Surgeon to the Rutherford Hospital. Rutherfordton, N. C.

1892. Norris, Richard C., M.D., Lecturer on Clinical and Operative Obstetrics in the University of Pennsylvania; Obstetrician in Charge of the Preston Retreat; Visiting Obstetrician to the Philadelphia General Hospital; Gynecologist to the Methodist Episcopal Hospital, and Consulting Obstetrician and Attending Gynecologist to the Southeastern Dispensary and Hospital. 500 N. Twentieth St.

1913. O'Neal, Alexander H., A.B., A.M., M.D., Physician to the Cathcart and Richardson Homes, Devon; Anesthetizer to the Bryn Mawr Hospital. St. Davids, Pa.

1920. Ostheimer, Alfred J., A.B., M.D., L.R.C.P. (London), M.R.C.S. (England), Neurologist to Abington Memorial Hospital; Chief, Neuro-psychiatric Section, District No. 3, United States Veteran's Bureau. Jenkintown, Pa.

1903. Ostheimer, Maurice, A.B., M.D., Associate in Pediatrics in the University of Pennsylvania; Physician-in-Charge of the Children's Dispensary and Assistant Visiting Pediatric Physician, University Hospital. 2204 De Lancey Place.

ELECTED

1913. Outerbridge, George W., A.B., M.D., Associate Professor of Gynecology, Graduate School of Medicine, University of Pennsylvania; Assistant Gynecologist to the Methodist Hospital; Gynecologist to the Abington Memorial Hospital. 1927 Spruce St.

1915. Owen, Hubley R., M.D., Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the Orthopædic Hospital; Chief Surgeon of the Bureaus of Police and Fire, Philadelphia. 319 S. Sixteenth St.

1897. Packard, Francis R., M.D., Chief of the Ear, Nose and Throat Service, Pennsylvania Hospital; Consulting Laryngologist and Aurist, Bryn Mawr Hospital; Consulting Aurist Chestnut Hill Hospital; Laryngologist, Children's Hospital of Philadelphia. 304 S. Nineteenth St.

1898. Page, Henry F., M.D., Assistant Physician to the Lankenau Hospital and Physician to the Medical Dispensary of the same; Clinical Professor of Medicine in the Woman's Medical College of Pennsylvania. 315 S. Sixteenth St.

1906. Pancoast, Henry K., M.D., Professor of Roentgenology in the University of Pennsylvania and Roentgenologist to the University Hospital. Ardmore, Pa.

1909. Parish, Benjamin D., B.S., M.D., Assistant Instructor in Otology in the University of Pennsylvania; Assistant Surgeon to the Dispensary for Diseases of the Ear, University Hospital; Aurist and Laryngologist to St. Agnes' Hospital. 1927 Spruce St.

1899. Parke, William E., M.D., Consulting Obstetrician to the Episcopal Hospital; Associate Surgeon to the Kensington Hospital for Women; Gynecologist to the Frankford Hospital. 1739 N. Seventeenth St.

1910. Patterson, Ross Vernet, M.D., Dean and Associate Professor of Medicine, Jefferson Medical College; Physician to the Philadelphia General Hospital; Physician to the Protestant Episcopal Hospital; Assistant Physician to the Jefferson Hospital. 2126 Spruce St.

1903. Pearce, Richard M., M.D., Sc.D., Director of Division of Medical Education, Rockefeller Foundation. 61 Broadway, New York, N. Y. 2114 De Lancey Place.

1922. Pelouze, P. S., M.D., Instructor in Genito-urinary Diseases, University of Pennsylvania; Assistant Genito-urinary Surgeon, University Hospital; Associate Surgeon, Episcopal Hospital. 1831 Chestnut St.

ELECTED

1909. Pemberton, Ralph, M.S., M.D., Visiting Physician to the Presbyterian Hospital; Director of the Department of Clinical Chemistry in the Pathological Laboratory of the Presbyterian Hospital. 318 S. Twenty-first St.

†1889. Penrose, Charles Bingham, M.D., Ph.D. (Harvard), Formerly Professor of Gynecology in the University of Pennsylvania. 1720 Spruce St.

1914. Pepper, O. H. Perry, B.S., M.D., Assistant Professor of Medicine, University of Pennsylvania. Medical Arts Bldg.

†1902. Pepper, William, A.B., M.D., Dean of the School of Medicine, University of Pennsylvania; Member of the Council on Medical Education and Hospitals of the American Medical Association. University of Pennsylvania.

1916. Percival, Milton Fraser, M.D. 2332 S. Broad St.

1917. Peter, Luther C., A.M., M.D., Professor of Diseases of the Eye, Temple Medical School; Professor of Ophthalmology, University of Pennsylvania Graduate School. 1529 Spruce St.

1912. Petty, Orlando H., B.S., A.M., M.D., Instructor in Medicine in the Jefferson Medical College; Pathologist and Assistant Physician to St. Timothy's Hospital; Physician to the Kensington Dispensary for the Treatment of Tuberculosis. 6215 Ridge Ave.

1905. Pfahler, George E., M.D., Professor of Roentgenology in the Medico-Chirurgical Graduate School of Medicine, University of Pennsylvania; Director of the X-ray Laboratories at the Howard Hospital, Polyclinic Hospital and the Misericordia Hospital; Honorary member, Scandinavian Radiological Society. 1321 Spruce St.

1915. Pfeiffer, Damon B., A.B., M.D., Instructor in Surgery, University of Pennsylvania; Assistant Surgeon, University Hospital; Pathologist to the Lankenau Hospital; Assistant Surgeon, Presbyterian Hospital. 1822 Pine St.

1907. Pfromm, George W., Ph.G., M.D., Assistant Physician to the American Stomach Hospital; Consulting Physician to the German Protestant Home for the Aged. 1431 N. Fifteenth St.

1907. Phillips, Horace, M.D., Assistant Surgeon U. S. Public Health Service; Examining Physician, Office of the District Attorney. 905 Land Title Building.

1883. Piersol, George A., M.D., Sc.D., Emeritus Professor of Anatomy in the University of Pennsylvania. 4724 Chester Ave.

ELECTED

1911. Piersol, George Morris, B.S., M.D., Professor of Medicine Graduate School of Medicine, University of Pennsylvania; Professor of Medicine in the Woman's Medical College of Pennsylvania; Physician to the Philadelphia General Hospital. 1913 Spruce St.

1917. Piper, Edmund Brown, B.S., M.D., Associate in Obstetrics, University of Pennsylvania Medical School; Assistant Professor in Obstetrics, University of Pennsylvania Graduate School; Assistant Obstetrician to the University Hospital; Assistant Obstetrician and Gynecologist to the Philadelphia General Hospital. 1936 Spruce St.

1905. Pitfield, Robert L., M.D., Pathologist to the Germantown Hospital; Bacteriologist to the Chestnut Hill Hospital for Lung Diseases. 5211 Wayne Ave.

1922. Pleasants, Henry, Jr., A.B., M.D., Assistant Visiting Physician, Chester County Hospital, West Chester, Pa.; Assistant in Neurological Clinic, Orthopædic Hospital. West Chester, Pa.

1896. Posey, William Campbell, M.D., Ophthalmic Surgeon to the Howard Hospital; Consulting Ophthalmic Surgeon to the Wills Eye Hospital; Chairman of the Commission on the Conservation of Vision for Pennsylvania. 2049 Chestnut Street.

1899. Potts, Charles S., M.D., Professor of Neurology, Graduate School of Medicine, University of Pennsylvania; Neurologist to the Philadelphia General Hospital; Consulting Neurologist, Lankenau Hospital; Consulting Neurologist, Hospital for the Insane, Atlantic County, New Jersey, 2018 Chestnut St.

*1907. Price, George E., M.D. Suite 620, Paulsen Bldg., Spokane, Wash.

1920. Quicksall, William E., M.D. 1819 Spruce St.

1908. Radcliffe, McCluney, A.M. (Lafayette), M.D., LL.D., Consulting Ophthalmologist, Presbyterian Hospital; attending Surgeon to the Wills Eye Hospital. 1906 Chestnut St.

1913. Randall, Alexander, A.M., M.D., Assistant Instructor in Surgery in the University of Pennsylvania; Assistant Surgeon in the Genito-Urinary Dispensary of the University of Pennsylvania. 1306 Medical Arts Building.

ELECTED

1887. Randall, B. Alexander, M.A., M.D., Professor of Otology in the University of Pennsylvania; Ear Surgeon to the Children's Hospital; Consulting Aurist to the Pennsylvania Institution for the Deaf and Dumb, and to St. Timothy's Hospital. 1717 Locust St.

*1904. Ravenel, Mazyck P., M.D., Professor of Preventive Medicine and Bacteriology and Director of the Public Health Laboratory at the University of Missouri. 203 Hicks Ave., Columbia, Mo.

1920. Rehfuss, Martin E., M.D. N. E. Cor. 16th and Spruce Sts.

1921. Reiff, E. Paul, A.B., M.D., Member of Medical Staff, Methodist Episcopal Hospital. 5051 Chestnut St.

1919. Reiman, Stanley P., M.D. 516 Arbutus St., Gtn.

1897. Rhein, John H. W., M.D., Professor of Nervous Diseases, Graduate School of Medicine, University of Pennsylvania; Neuropsychiatrist to the Philadelphia General Hospital; Consulting Neurologist to the Philadelphia Home for Incurables. 1732 Pine St.

1906. Rhein, Robert D., M.D., Chief Physician to the Clinic of the American Hospital for Diseases of the Stomach; Physician to the Philadelphia Home for Incurables; Examining Physician to the White Haven Sanatorium. S. W. Cor. 15th and Pine Sts.

1891. Rhoads, Edward G. M.D., 108 Queen Lane, Germantown.

*1910. Rhoads, Samuel, M.D. Pasadena, California.

1919. Richardson, Russell, A.M., M.D., Director of the Laboratory, Methodist Episcopal Hospital; Pathologist to Abington Memorial and Chestnut Hill Hospitals. 320 S. Sixteenth St.

1919. Ridpath, Robert F., M.D. 1928 Chestnut St.

1898. Riesman, David, M.D., Professor of Clinical Medicine, University of Pennsylvania; Visiting Physician to the Philadelphia General Hospital; Consulting Physician to the Jewish and Woman's Hospitals. 1715 Spruce St.

1895. Ring, G. Oram, A.M., M.D., Orphthalmic Surgeon to the Episcopal Hospital; Ophthalmologist to the Widener Memorial Home for Crippled Children; Consulting Ophthalmologist to the American Oncologic Hospital. N. E. Cor. Seventeenth and Walnut Sts.

*1905. Risley, J. Norman, M.D. New Bedford, Mass.

†1878. Roberts, John B., A.M., M.D., Professor of Surgery in the University of Pennsylvania Graduate School of Medicine. 1520 Spruce St.

ELECTED

1899. Roberts, Walter, M.D., Professor of Otology in the Philadelphia Polyclinic; Otologist to the Methodist Episcopal Hospital; Laryngologist to the Philadelphia General Hospital. 1732 Spruce St.

1903. Robertson, William Egbert, M.D., Professor of Theory and Practice of Medicine and of Clinical Medicine in Temple University; Physician to the Episcopal, Samaritan, and Garretson Hospitals. 327 S. Seventeenth St.

1902. Robinson, James Weir, M.D. 326 S. Sixteenth St.

1903. Robinson, William Duffield, Ph.G., M.D. 2012 Mount Vernon St.

1912. Rodman, John Stewart, M.D., Lecturer on Surgery in the Medico-Chirurgical College; Assistant Surgeon to the Medico-Chirurgical Hospital; Assistant Surgeon to the Presbyterian Hospital; Assistant Surgeon to the Outpatient Department of the Pennsylvania Hospital. 1310 Medical Arts Building.

1909. Rosenberger, Randle C., M.D., Professor of Hygiene and Bacteriology in the Jefferson Medical College. 2330 N. Thirteenth St.

1898. Ross, George G., M.D., Visiting Surgeon, Germantown, Stetson and Methodist Hospitals; Assistant Surgeon, Lankenau Hospital; Assistant Surgeon, Hospital of the University of Pennsylvania; Associate in Surgery, University of Pennsylvania School of Medicine. 1721 Spruce St.

*1907. Royer, B. Franklin, M.D., Mass.-Halifax Health Commission. Halifax, Nova Scotia.

†1905. Rugh, James Torrance, A.B., M.D., Clinical Professor of Orthopedic Surgery in the Woman's Medical College of Pennsylvania; Orthopedic Surgeon to the Jefferson Medical College; Orthopedic Surgeon to the Methodist and the Philadelphia General Hospitals. 1616 Spruce St.

1897. Sailer, Joseph, Ph.B., M.D., Professor of Clinical Medicine in University of Pennsylvania; Physician to the Philadelphia General, the University, and Presbyterian Hospitals. 1718 Spruce St.

1900. Sajous, Charles E. de M., M.D., LL.D., ScD., Knight of the Legion of Honor of France; and of the Order of Leopold of Belgium; Professor of Therapeutics in Temple University Medical School. 2043 Walnut St.

ELECTED

1905. Sartain, Paul J., A.M., M.D. 2006 Walnut St.

1908. Sautter, Albert C., M.D., Assistant in the Dispensary for Diseases of the Eye in the University Hospital; Assistant in the Eye Dispensary of the Lankenau Hospital, 1421 Locust St.

1906. Saylor, Edwin S., M.D., Chief Ophthalmologist to the Diagnostic Hospital of Philadelphia. 2005 Chestnut St.

1920. Scarlett, Hunter W., M.D. 230 S. Twenty-first St.

*1910. Scarlett, Rufus B., M.D., Laryngologist to the Home for Consumptives at Chestnut Hill; Assistant in the Department for Diseases of the Ear, Throat, and Nose of the Pennsylvania Hospital; Instructor in Diseases of the Nose and Throat in the Philadelphia Polyclinic and College for Graduates in Medicine. 78 N. Clinton Ave., Trenton, N. J.

1917. Schaeffer, Jacob Parsons, A.M., M.D., Ph.D., Professor of General Anatomy and Director of the Daniel Baugh Institute of Anatomy of the Jefferson Medical College. 4634 Spruce St.

1899. Schamberg, Jay F., M.D., Professor of Dermatology and Infectious Eruptive Diseases, Graduate School, University of Pennsylvania. 1922 Spruce St.

1917. Schnabel, Truman Gross, A.B. (Lehigh), M.D., Associate in Medicine, University of Pennsylvania; Assistant Physician, Philadelphia General Hospital; Physician in the Medical Out-patient Department, University Hospital. 1704 Pine Street.

1917. Schoff, Charles H., M.D. Media, Pa.

1921. Schumann, Edward Armin, A.B., M.D., Obstetrician and Gynecologist, Philadelphia General Hospital; Gynecologist, Frankford Hospital; Lecturer on Obstetrics, Jefferson Medical College; Consulting Gynecologist, Rush Hospital. 1814 Spruce St.

1887. de Schweinitz, George Edmund, A.M., M.D., LL.D., Professor of Ophthalmology in the University of Pennsylvania; Consulting Ophthalmic Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases, The Philadelphia Polyclinic and School for Graduates in Medicine, and the Philadelphia General Hospital; Ophthalmic Surgeon to the University Hospital. 1705 Walnut St.

*1913. de Schweinitz, George Lord, B.S., M.D., Assistant in the Department of Ophthalmology, St. Luke's Hospital, Bethlehem, Pa. 85 East Broad St., Bethlehem, Pa.

ELECTED

1910. Schwenk, Peter N. K., M.A., M.D., Attending Surgeon to the Eye Department of the Pennsylvania Hospital; Attending Surgeon to the Wills Eye Hospital. 1417 N. Broad Street.

1892. Seiss, Ralph W., M.D., Professor of Otology in the Philadelphia Polyclinic; Consulting Laryngologist to the Pennsylvania Institution for the Deaf and Dumb. 255 S. Seventeenth St.

1917. Service, Charles A., M.D. Bala, Pa.

1908. Shannon, Charles E. G., A.B., M.D., Instructor in Ophthalmology in the Jefferson Medical College; Assistant in the Ophthalmological Clinic at the Jefferson Medical College Hospital; Ophthalmologist to the Seybert Institution. N. E. Corner Seventeenth and Walnut Sts.

1897. Sharpless, William T., M.D., Physician to the Chester County Hospital. West Chester, Pa.

1906. Shields, William G., M.D., Dermatologist to Germantown Hospital; Chief of Dermatological Clinic and Assistant Physician to the Jewish Hospital. 414 School Lane, Germantown.

*1908. Shoemaker, Harlan, A.B., M.D., Lecturer in Surgery, University of Southern California; Surgeon to Los Angeles County Hospital; Surgeon to Washington Street Clinic. 621 March Strong Building, Los Angeles, Cal.

†1893. Shoemaker, Harvey, M.D., Visiting Physician to the Sheltering Arms; Consulting Physician to the Southern Home for Destitute Children; Assistant Physician to the Lankenau Hospital; Physician to the Out-patient Department of the Lankenau Hospital. 1727 Spruce St.

†1896. Shoemaker, William T., M.D., Professor of Ophthalmology, Graduate School of Medicine, University of Pennsylvania; Clinical Professor of Ophthalmology in the Woman's Medical College of Pennsylvania; Ophthalmic Surgeon to Lankenau, Germantown and Pennsylvania Hospitals. 109 S. Twentieth St.

1900. Shumway, Edward Adams, B.S., M.D., Ophthalmic Surgeon to the Philadelphia General, Lankenau and Children's Hospitals; Assistant Professor of Ophthalmology in the University of Pennsylvania, and Assistant Ophthalmic Surgeon to the University Hospital. 2046 Chestnut St.

1903. Sinclair, John Falconer, M.D., Epidemilogist, Presbyterian Hospital; Physician to the Philadelphia Orphan Asylum

ELECTED

and to the Presbyterian Orphanage; Physician to the Home of the Merciful Saviour for Crippled Children. 4103 Walnut St.

1907. Sinkler, Francis Wharton, A.B., M.D., Physician to the Orthopædic Hospital and Infirmary for Nervous Diseases; Physician to the Episcopal Hospital. 1606 Walnut Street.

1902. Siter, E. Hollingsworth, M.D., Associate in Genito-urinary Surgery in the University of Pennsylvania; Genito-urinary Surgeon to the Philadelphia General Hospital; Surgeon-in-Charge of the Genito-urinary Dispensary of the University Hospital; Consulting Genito-urinary Surgeon to the Eastern Penitentiary and to the Philadelphia County Prison. 512 Medical Arts Building.

1904. Skillern, Penn-Gaskell, M.D. 241 S. Thirteenth St.

1920. Skillern, Ross Hall, M.D., Professor of Laryngology, Graduate School of Medicine, University of Pennsylvania; Laryngologist to Medico-Chirurgical Hospital. 1928 Chestnut St.

1904. Smith, Allen J., A.M., M.D., Sc.D. (Penna. Coll.), LL.D. (McGill Univ.), Professor of Pathology and of Comparative Pathology, and Director of Courses in Tropical Medicine in the University of Pennsylvania. Medical Laboratories, University of Pennsylvania.

1905. Smith, S. MacCuen, M.D., Professor of Otology in the Jefferson Medical College; Aurist and Laryngologist to the Germantown Hospital; Aurist to the Jewish Hospital; Consulting Aurist to the Memorial Hospital, Roxborough; and to the Oncologic Hospital. 1429 Spruce St.

1919. Smyth, Henry Field, M.D. Wayne, Pa.

1908. Speese, John, M.D., Assistant Professor Surgical Pathology, University of Pennsylvania; Associate Professor in Surgery, Graduate School of Medicine, University of Pennsylvania; Surgeon to the Children's and Presbyterian Hospitals. 2032 Locust St.

1895. Spellissy, Joseph M., A.M., M.D., Visiting Surgeon to St. Joseph's and to the Methodist Episcopal Hospitals; Assistant Surgeon to the Orthopedic Department of the University Hospital. 317 S. Fifteenth St.

1897. Spiller, William G., M.D., Professor of Neurology in the University of Pennsylvania; Clinical Professor of Nervous

ELECTED

Diseases in the Woman's Medical College of Pennsylvania; Neurologist to the Philadelphia General Hospital; Consultant Neurologist to the Pennsylvania Hospital. 4409 Pine St.

1894. STAHL, B. FRANKLIN, B.S., Ph.G., M.D., Visiting Physician to St. Agnes' and the Philadelphia General Hospitals. 1727 Pine St.

1909. STARBUCK, J. CLINTON, M.D., Physician to the Orphanage, Orphan Society of Philadelphia at Wallingford and to the Glen Mills School, Glen Mills, Pa. 42 E. Washington St., Media, Pa.

*1875. STARR, LOUIS, M.D., LL.D. (Haverford). Care of Brown, Shipley & Co., London, England.

1912. STAUFFER, NATHAN PENNYPACKER, D.D.S., M.D., Laryngologist and Otologist to the Presbyterian Hospital; to the Philadelphia General Hospital, Tubercular Department; to the Home for Crippled Children. 1819 Walnut St.

1910. STELLWAGEN, THOMAS C., JR., M.D., Chief Clinical Assistant in the Out-patient Surgical Department of the Jefferson Medical College Hospital. 1912 Pine St.

1895. STENGEL, ALFRED, M.D., Sc.D., Professor of Medicine in the University of Pennsylvania; Physician to the University Hospital and the Pennsylvania Hospital. 1728 Spruce Street.

1901. STEVENS, ARTHUR A., M.D., Professor of Materia Medica, Therapeutics, and Clinical Medicine in the Woman's Medical College of Pennsylvania; Lecturer on Physical Diagnosis in the University of Pennsylvania; Physician to the Episcopal and St. Agnes' Hospitals. 314 S. Sixteenth Street.

1914. STEWART, THOMAS S., B.S. (Univ. of Penna.), M.D. 301 S. Eighteenth St.

1921. STONER, WILLIAM H., A.B., A.M., Ph.C., Pharm. D., M.D., Biochemist, Philadelphia Hospital; Associate Professor of Biochemistry, Graduate School of Medicine, University of Pennsylvania. Medical Laboratories, University of Pennsylvania.

1898. STOUT, GEORGE C., M.D., Professor of Otology in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Laryngologist and Aurist to the Presbyterian Hospital, the Children's Aid Society, and the William Penn Charter School. 2015 Walnut St.

ELECTED

1884. STRYKER, SAMUEL S., M.D., Consulting Physician to the Presbyterian Hospital. 3833 Walnut St.

*1900. SWAN, JOHN M., M.D. 457 Park Avenue, Rochester, New York.

1898. SWEET, WILLIAM M., M.D., Clinical Professor of Ophthalmology in the Jefferson Medical College, and Ophthalmic Surgeon to the Jefferson Medical College Hospital; Consulting Surgeon to the Wills Eye Hospital. 1205 Spruce St.

1900. TALLEY, JAMES ELY, A.B., M.D., Professor of Cardiology, Graduate School of Medicine, University of Pennsylvania; Physician to the Presbyterian and Methodist Episcopal Hospitals. 1811 Spruce St.

1886. TAYLOR, JOHN MADISON, A.B. and A.M. (Princeton), M.D., Professor of Physical Therapeutics and Diatetics, Medical Department Temple University. 1504 Pine St.

1887. TAYLOR, WILLIAM J., M.D., Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women. 1825 Pine St.

1886. TAYLOR, WILLIAM L., M.D. 2223 Tioga St.

†1910. THOMAS, BENJAMIN A., A.B., A.M., M.D., Professor of Genito-urinary Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Genito-urinary Surgeon, Presbyterian Hospital; Instructor in Surgery in the University of Pennsylvania; Surgeon-in-Chief, Genito-urinary Department of the Out-patient Department of the University Hospital. 116 S. Nineteenth St.

1912. THOMAS, FRANK WISTER, A.M., M.D., Visiting Physician to "Buttercup Cottage;" Consulting Physician to the Germantown Hospital. 27 E. Mt. AiryAve.

1907. THOMAS, THOMAS TURNER, M.D., Associate Professor of Applied Anatomy, and Associate in Surgery in the University of Pennsylvania; Surgeon to the Philadelphia General Hospital; Assistant Surgeon to the University Hospital. 1905 Chestnut St.

1896. THORINGTON, JAMES, A.M., M.D., Emeritus Professor of Diseases of the Eye in the Philadelphia Polyclinic and College for Graduates in Medicine; Ophthalmic Surgeon to the Presbyterian Hospital; Ophthalmologist to the Ellwyn, Pa., Training School for Feeble-minded Children. 2031 Chestnut St.

ELECTED

1898. Thornton, Edward Q., M.D., Assistant Professor of Materia Medica in the Jefferson Medical College. 1331 Pine St.

1912. Torrey, Robert G., M.D., Assistant Physician to the Philadelphia General Hospital; Physician to the State Tuberculosis Dispensary. 1716 Locust St.

1896. Toulmin, Harry, M.D. Haverford, Pa.

1908. Tracy, Stephen E., M.D., Gynecologist to the Stetson Hospital; Visiting Surgeon to the Gynecean Hospital. 1527 Spruce St.

1901. Tucker, Henry, M.D., Care Morgan, Harjes & Co., Paris France.

†1894. Tunis, Joseph Price, M.D., Assistant Professor of Histology and Embryology, Temple University. 2216 De Lancey St.

1901. Turner, John B., M.D., Ph.D., Assistant in the Ophthalmological Clinic, Methodist Episcopal Hospital. 1833 Chestnut St.

1897. Tyson, T. Mellor, M.D., Physician to the Philadelphia General Hospital; Physician to the Rush Hospital, the Philadelphia Lying-in-Charity Hospital, and the Children's Aid Society of Philadelphia. 1506 Spruce St.

1907. Ullom, Josephus Tucker, M.A., M.D., Physician to the Chestnut Hill Hospital. Carpenter and Quincy Streets, Germantown.

*1913. Vail, William Penn, B.S., M.S., M.D., Laryngologist to the Pennsylvania Institution for the Instruction of the Blind; Laryngologist to the Department for Tuberculosis of the Philadelphia General Hospital; Assistant Laryngologist and Otologist to the Out-patient Department of the Pennsylvania Hospital; Assistant Laryngologist to the Children's Hospital. Blairstown, N. J.

°1873. Van Harlingen, Arthur, Ph.B. (Yale), M.D., Emeritus Professor of Diseases of the Skin in the Philadelphia Polyclinic. 1831 Chestnut St.

1903. Van Pelt, William Turner M.D. 1100 Widener Building.

1893. Vansant, Eugene Larue, M.D. 2046 Chestnut St.

1912. Vaux, Norris Wistar, M.D., Surgeon to the Chestnut Hill Hospital; Surgeon to the Dispensary of the Germantown Hospital. 1807 Walnut St.

*1897. Veasey, Clarence A., A.M., M.D. Suite 404, Paulsen Building, Spokane, Wash.

†1883. Vinton, Charles Harrod, A.M., M.D. P. O. Box 464, Atlantic City, N. J.

ELECTED

1903. Wadsworth, William Scott, M.D. 3914 Baltimore Ave.

1906. Walker, John K., M.D., Physician to the Children's Hospital of the Mary J. Drexel Home; Physician to the Out-patient Department of the Pennsylvania Hospital. 1819 De Lancey St.

1907. Walker, Warren, M.D., Dermatologist to the Episcopal and Howard Hospitals; Assistant Dermatologist to the Pennsylvania Hospital. 206 Church Road, Ardmore, Pa.

1904. Walsh, Joseph, A.M., M.D., Visiting Physician to and Medical Director of the White Haven Sanatorium; Medical Director of St. Agnes' Hospital. 2026 Chestnut St.

1910. Ward, E. Tillson, A.M., M.D. 2006 Mt. Vernon St.

1895. Watson, Arthur W., M.D., Professor of Diseases of the Throat and Nose in the Philadelphia Polyclinic and College for Graduates in Medicine; Laryngologist to the Jewish Hospital; Laryngologist and Aurist to the Mt. Sinai Hospital; Laryngologist to Home for Incurables. 126 S. Eighteenth Street.

1886. Watson, Edward W., M.D., Physician to the Magdalene Home. 38 S. Nineteenth St.

1903. Weber, Charles H., M.D., Physician to the Dispensary of the Children's Hospital. 1811 Spruce St.

1920. Weidman, Fred. D., M.D., Assistant Director, Laboratory of Dermatological Research, University of Pennsylvania; Assistant Pathologist, Philadelphia Zoölogical Garden and University Hospital. 20 Tenby Road, Llanerch, Pa.

1906. Weisenburg, Theodore H., M.D., Professor of Neurology, Graduate School of Medicine, University of Pennsylvania; Neurologist, Philadelphia General Hospital and Orthopædic Hospital and Infirmary for Nervous Diseases. 1909 Chestnut St.

1913. Wells, P. Frailey, A.M., M.D., Ph.D 754 N. Fortieth St.

1893. Westcott, Thompson S., M.D., Associate in Diseases of Children in the University of Pennsylvania; Pediatrist to the Methodist Episcopal Hospital; Consulting Physician, Haddock Memorial Home. 1720 Pine St.

1884. Wharton, Henry R., M.D., Consulting Surgeon to the Presbyterian and the Children's Hospitals; Surgeon to Girard College; Consulting Surgeon to the Bryn Mawr Hospital, the Chestnut Hill Hospital, St. Christopher's Hospital for Children, the Pennsylvania Institution for the Deaf and Dumb, and the Pennsylvania Institution for the Blind. Berwyn, Pa.

ELECTED

1921. WHITAKER, WILLIAM, M.D., Surgeon to Dispensary of the Episcopal Hospital. 5448 Germantown Ave.

1901. WHITE, COURTLAND Y., M.D., Director of the Pathological Laboratories of the Episcopal Hospital; Pathologist to the Children's Hospital and to the Kensington Hospital for Women; Chief Bacteriologist to the Bureau of Health, Department of Health and Charities, Philadelphia. 6611 N. Tenth St.

*1905. WHITEWAY, HAROLD M., M.D. 2356 W. Twenty-first St., Los Angeles, Cal.

1898. WHITING, ALBERT D., M.D., Surgeon, Germantown Hospital; Assistant Surgeon, Lankenau Hospital. 1523 Spruce St.

1914. WILLARD, DE FOREST P., B.S. (Univ. of Penna.), M.D., Professor of Orthopædics, Graduate School of Medicine, University of Pennsylvania; Clinical Professor of Orthopædic Surgery, Woman's Medical College; Orthopædic Surgeon to the Polyclinic, Jewish and Delaware Hospitals. 1630 Spruce St.

1907. WILLIAMS, CARL, B.S., M.D., Ophthalmic Surgeon to the Germantown Hospital; Instructor in Ophthalmology in the University of Pennsylvania; Ophthalmic Surgeon to the Pennsylvania Institution for the Deaf and Dumb. School Lane and Greene Sts., Germantown.

1920. WILLIAMS, PHILIP F., Ph.B., M.D., Assistant Professor of Obstetrics, Graduate School of Medicine, University of Pennsylvania; Instructor in Obstetrics, School of Medicine, University of Pennsylvania; Obstetrician to the Maternity Hospital of Philadelphia and Assistant Gynecologist to the Presbyterian Hospital. 262 S. Twenty-first St.

1916. WILMER, HARRY B., M.D., Assistant Instructor in Medicine, University of Pennsylvania: Assistant Visiting Physician and Assistant Neurologist to the Germantown Hospital; Visiting Chief to the Dispensary of the Germantown Hospital. 138 W. Walnut Lane, Germantown.

1921. WILSON, GEORGE, M.D., Instructor in Medicine and Neurology, School of Medicine, University of Pennsylvania; Assistant Physician, Philadelphia Hospital; Assistant Neurologist, Philadelphia, University and Children's Hospitals; Consulting Neurologist, St. Christopher's Hospital and the Pennsylvania Training School for Feeble-minded Children. 1909 Chestnut St.

ELECTED

1874. Wilson, James Cornelius, A.M. (Princeton), M.D., Emeritus Professor of the Practice of Medicine and of Clinical Medicine in the Jefferson Medical College; Physician-in-Chief to the Lankenau Hospital; Emeritus Physician to the Pennsylvania Hospital; Consulting Physician to the Bryn Mawr Hospital. 1509 Walnut St.

1902. Wilson, Samuel M., M.D. 2018 Chestnut St.

1897. Wilson, W. Reynolds, M.D. 1709 Spruce St.

1904. Wister, James W., M.D., Physician to the Out-patient Department of the Germantown Hospital. 5430 Germantown Ave.

*1901. Witmer, A. Ferree, M.D. Freeport, Long Island, N. Y.

1918. Wolferth, Charles Christian, A.B., M.D., Associate in Medicine, University of Pennsylvania; Associate in Cardiac Pathology, William Pepper Laboratory of Clinical Medicine, University of Pennsylvania. 1704 Pine St.

1893. Wood, Alfred C., M.D., Assistant Professor of Surgery in the University of Pennsylvania; Surgeon to the University, the Philadelphia General, St. Timothy's, and the Howard Hospitals. 2035 Walnut St.

1900. Wood, George, B., M.D., Laryngologist and Otologist, Orthopædic and Howard Hospitals; Professor of Laryngology, Graduate School, University of Pennsylvania. 1830 Spruce St.

1903. Wood, Horatio C., Jr., M.D., Professor of Pharmacology and Therapeutics in the University of Pennsylvania; Professor of Materia Medica, Philadelphia College of Pharmacy and Science. 1905 Chestnut St.

1880. Woodbury, Frank, M.D., Secretary to the Committee on Lunacy of the Board of Charities of Pennsylvania. 3345 N. Seventeenth St.

*1911. Woods, Andrew H., A.B., M.D., Associate Professor of Medicine, Head of Division of Neurology, Peking. Union Medical College, Peking, China.

†1897. Woodward, George, M.D. W. Willow Grove Ave., Chestnut Hill, Philadelphia.

1913. Woodward, W. Wellington, M.D. 26 S. Church St., West Chester, Pa.

1903. Worden, Charles B., A.M., M.D. Princeton, N. J.

ELECTED

1889. Young, James K., M.D., Professor of Orthopædics, Graduate School of Medicine, University of Pennsylvania; Orthopædic Surgeon, Philadelphia General Hospital; Consulting Orthopædic Surgeon, Woman's Hospital and Philadelphia Lying-in-Charity. 222 S. Sixteenth St.

1894. Zentmayer, William, M.D., Professor of Ophthalmology Graduate School of Medicine, University of Pennsylvania; Attending Surgeon to the Wills Eye Hospital; Ophthalmologist to the Glen Mills School. 1506 Spruce St.

1899. Ziegler, S. Lewis, A.M., M.D., LL.D., Attending Surgeon to the Wills Eye Hospital; Chief Ophthalmic Surgeon to St. Joseph's Hospital; Membre Société Française d'Ophthalmologie. 1625 Walnut St.

1887. Ziegler, Walter M. L., A.M., M.D. 1418 N. Seventeenth St.

1895. Zimmerman, Mason W., M.D., Consulting Ophthalmic Surgeon to the Germantown Hospital. 1518 Waverly St.

ASSOCIATE FELLOWS

(Limited to Fifty, of whom Twenty may be Foreigners)

American

ELECTED

1911. Abbe, Robert, M.D. 13 W. Fiftieth St., New York City, New York.

1909. Billings, Frank, M.D., 1550 North State Parkway, Chicago, Illinois.

1893. Councilman, William T., M.D., Harvard Medical College, Boston, Massachusetts.

1909. Crile, George W., M.D., 1021 Prospect Avenue, S. E., Cleveland, Ohio.

1909. Dana, Charles Loomis, M.D., 53 West Fifty-third Street, New York City, New York.

1892. Emmet, Thomas Addis, M.D., 91 Madison Avenue, New York City, New York.

1912. McCaw, Brig.-Gen. Walter D., M.D. Assistant Surgeon-General, U. S. A., Army Medical School, Washington, D. C.

1906. Mayo, William J., M.D., Rochester, Minnesota.

1906. Pilcher, Lewis Stephen, M.D., 145 Gates Avenue, Brooklyn, New York.

1906. Shattuck, Frederick C., M.D., 135 Marlborough Street, Boston, Massachusetts.

1894. Warren, J. Collins, M.D., 58 Beacon Street, Boston, Massachusetts.

1894. Weir, Robert F., M.D., 1155 Park Avenue (Ninety-second Street), care of Mrs. Ed. La Montayne, New York City, New York.

1892. Welch, William H., M.D., Johns Hopkins Hospital, Baltimore, Maryland.

Foreign

1890. Baccelli, Guido, Rome, Italy.
1908. Bannerman, W. B., M.D., General, I. M. S., 11 Strathearn Place, Edinburgh, Scotland.
1909. Macallum, Archibald B., M.A., M.B., Ph.D., Sc.D., LL.D., F.R.S., Department of Biochemistry, McGill University, Montreal, Canada.
1922. McCarrison, Robert, M.D. (London), D.Sc., (Oxford Eng.) LL.D. (India.)
1906. Myles, Sir Thomas, M.D., 33 Merion Square, W., Dublin, Ireland.
1898. Roddick, Thomas G., M.D., 80 Union Avenue, Montreal, Canada.
1908. Ross, Col. Sir Ronald, K.C.B., K.C.M.G., F.R.S., M.D., D.Sc., LL.D., 36 Harley House, London, N. W. I., England.

CORRESPONDING MEMBERS

1880. Carrow, Flemming, M.D., 823 David Whitney Building, Detroit, Mich.
1885. Rendu, Jean, M.D., Lyons, France.
1916. Estes, William Lawrence, M.D., South Bethlehem, Pa.
1916. Guitéras, John, M.D., Benavides, Cuba.
1917. Miner, Charles H., M.D., Wilkes-Barre, Pa.
1917. Stevens, Cyrus L., M.D., Athens, Pa.

NECROLOGICAL LIST

FELLOWS

J. MORTON BOICE, M.D.	December 2, 1921
GEORGE E. SHOEMAKER, M.D.	January 5, 1922
JAMES W. HOLLAND, M.D.	February 10, 1922
GEORGE M. GOULD, M.D.	August 8, 1922
GEORGE A. CAMERON, M.D.	August 25, 1922
ALEXANDER R. CRAIG, M.D.	September 2, 1922

LIST OF PRIZES AND LECTURES

THE WILLIAM F. JENKS MEMORIAL PRIZE

(Triennial)

1889	John Strahan, M.D.	Belfast (Ireland).
1895	Abram Brothers, M.D.	New York.

NOTE—June 12, 1900, the William F. Jenks Memorial Prize Fund was transferred to the Library as the "William F. Jenks Memorial Library Fund."

ALVARENGA PRIZE OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA

(Annual)

1890	R. W. Philip, M.D.	Edinburgh (Scotland).
1891	L. Duncan Bulkley, M.D.	New York.
1892	R. H. L. Bibb, M.D.	Saltillo.
1894	G. E. de Schweinitz, M.D.	Philadelphia.
1895	Guy Hinsdale, M.D.	Philadelphia.
1897	Joseph Collins, M.D.	New York.
1898	S. A. Knopf, M.D.	New York.
1899	Robert Randolph, M.D.	Baltimore.
1900	David de Beck, M.D.	Cincinnati.
1901	George W. Crile, M.D.	Cleveland.
1903	William S. Carter, M.D.	Galveston.
1905	D. Chalmers Watson, M.D.	Edinburgh (Scotland).
1907	William Louis Chapman, M.D.	Providence.
1908	William T. Shoemaker, M.D.	Philadelphia.
1910	M. Katzenstein, M.D.	Berlin (Germany).
1911	Francis D. Patterson, M.D.	Philadelphia.
1914	H. B. Sheffield, M.D.	New York.
1915	J. E. Sweet, M.D.	Philadelphia.
1917	Wilburt C. Davison, M.D.	Baltimore.
1921	John W. Churchman, M.D.	New York

NATHAN LEWIS HATFIELD PRIZE FOR ORIGINAL RESEARCH IN MEDICINE

(Triennial)

1901	Henry F. Harris, M.D.	Atlanta.
1909	Martin Henry Fischer, M.D.	Oakland.
1917	A. B. Macallum, M.D., F.R.S.	Toronto.
1919	Harvey Cushing, M.D.	Boston.
1921	William R. Nicholson, M.D.	Philadelphia
1922	Sir Thomas Lewis, C.B.E., M.D., F.R.S.	London, (Eng.)

NOTE.—November 29, 1913, by Supplemental Deed of Trust, the title of this Fund was changed to "Nathan Lewis Hatfield Prize and Lectureship."

WEIR MITCHELL LECTURES

Jan. 17, 1911	Arthur R. Cushny, M.D.	London.
Mar. 30, 1911	Edmund B. Wilson, Ph.D., LL.D.	New York.
May 16, 1911	Svante Arrhenius	Stockholm.
Nov. 3, 1911	William T. Porter, M.D.	Boston.
Mar. 29, 1912	William H. Howell, M.D.	Baltimore.
Oct. 21, 1912	G. H. F. Nuttall, F.R.S., M.D.	Cambridge (Eng).
April 4, 1913	H. P. Armsby, Ph.D., LL.D.	Pennsylvania.
Feb. 25, 1914	Harvey Cushing, M.D.	Boston.

PUBLIC LECTURES

Feb. 16, 1910	S. Weir Mitchell, M.D.	Philadelphia.
Nov. 17, 1910	Simon Flexner, M.D.	New York.
Dec. 15, 1910	William H. Welch, M.D.	Baltimore.
April 18, 1911	James G. Mumford, M.D.	Clifton Springs, N. Y.
Nov. 20, 1911	Talcott Williams, A.M., LL.D., Litt.D.	Philadelphia.
April 29, 1912	Owen Wister, A.M., LL.D.	Philadelphia.
Feb. 17, 1913	John K. Mitchell, M.D.	Philadelphia.
Feb. 15, 1916	Daniel J. McCarthy, M.D. and Walter Estell Lee, M.D.	Philadelphia.
April 15, 1916	Surgeon A. M. Fauntleroy	U. S. Navy.

MARY SCOTT NEWBOLD LECTURES

Mar. 29, 1917	A. T. McCormack, M.D.	Bowling Green, Ky.
April 4, 1919	Col. Thomas W. Salmon, M.C.,	U. S. Army.
Feb. 6, 1920	Alonzo E. Taylor, M.D.	Philadelphia.
Feb. 4, 1921	Maj.-Gen. Merritte W. Ireland	Washington.
April 20, 1921	Prof. William Romaine Newbold	Philadelphia.
Nov. 11, 1921	Robert McCarrison, M.D., D.Sc. LL.D.	Oxford, (Eng).
Feb. 1, 1922	Hans Zinsser, M.D.	New York.
April 5, 1922	G. Canby Robinson, M.D.	Baltimore.

MÜTTER LECTURES

1865	J. H. Packard, M.D.	Philadelphia.
1866	J. H. Packard, M.D.	Philadelphia.
1867	J. H. Packard, M.D.	Philadelphia.
1868	Harrison Allen, M.D.	Philadelphia.
1869	J. H. Brinton, M.D.	Philadelphia.
1872	J. da S. Solis Cohen, M.D.	Philadelphia.
1879	S. W. Gross, M.D.	Philadelphia.
1882	E. O. Shakespeare, M.D.	Philadelphia.
1885	H. F. Formad, M.D.	Philadelphia.
1888	O. H. Allis, M.D.	Philadelphia.
1890–1891	Roswell Park, M.D.	Buffalo.
1893–1894	De Forrest Willard, M.D., and Guy Hinsdale, M.D.	Philadelphia.
1896	O. H. Allis, M.D.	Philadelphia.
1899–1900	J. B. Roberts, M.D.	Philadelphia.
1901	H. W. Cushing, M.D.	Boston.
1902	L. A. La Garde, M.D.	Washington.
1903	C. N. B. Camac, M.D.	New York.
1904	G. H. Monks, M.D.	Boston.
1905	A. O. J. Kelly, M.D.	Philadelphia.
1906	W. J. Mayo, M.D.	Rochester, Minn.
1907	J. Rogers, M.D., and S. P. Beebe, M.D.	New York.
1908	G. W. Crile, M.D.	Cleveland.
1909	H. D. Fry, M.D.	Washington.
1910	T. W. Hastings, M.D.	New York.
1911	C. F. Nassau, M.D.	Philadelphia.
1912	J. C. Bloodgood, M.D.	Baltimore.
1913	R. C. Coffey, M.D.	Portland, Ore.
1914	F. H. Albee, M.D.	New York.
1915–1916	Rudolph Matas, M.D.	New Orleans, La.
1916	Nelson M. Percy, M.D.	Chicago, Ill.
1917	Chevalier Jackson, M.D.	Philadelphia.
1919	Alexis V. Moschcowitz, M.D.	New York.
1920	J. Chalmers Da Costa, M.D.	Philadelphia.
1921	Professor H. C. Jacobaeus	Stockholm, (Swed.)
1922	James Ewing, M.D.	New York.

WEIR MITCHELL ORATION

1919	Charles W. Burr, M.D.	Philadelphia.
1922	Charles Loomis Dana, M.D.	New York.

MEMOIR OF M. HOWARD FUSSELL, M.D.[1]

By DAVID RIESMAN, M.D.

The historian Henry T. Buckle once said that the life of a London hatter was more interesting than that of any king. Had he known more about doctors he might have said that the life of a doctor is even more interesting than that of a hatter or than that of any other human being. Certainly the life of Dr. M. Howard Fussell was unusually full and rich; if we knew it in all its wealth of detail, and if the present writer were a Boswell, a Thayer or a Beveridge, Dr. Fussell's biography would be overflowing with romance and inspiration.

Dr. Fussell left us so recently that his personality is still with us. I feel that I must meet him on the steps of the University Hospital, carrying his black bag in one hand and swinging his stethoscope with the other. It is thus when a friend dies suddenly: one cannot accommodate oneself to the altered circumstances until time and the crowding of obliterative events have worn a new groove in the routine of life.

Dr. Fussell's ancestry was English. The first of the family to come to this country, Solomon Fussell, emigrated from England in 1704 and settled in Philadelphia. Little is known of his son William, who married Sarah Longstreth. Their son, Bartholomew Fussell, settled in Chester Springs, Chester County, Pennsylvania, and had a son, also called Bartholomew (1794–1871), who was the first doctor in the family. He practised at Kennet Square and was an ardent Abolitionist and a Signer of the Declaratior

[1] Read April 5, 1922.

of Sentiments of the Pennsylvania Anti-Slavery Society. Evidently a progressive spirit, he was an advocate of the fitness of women for the practice of medicine, and in 1849 began to give a regular course of instruction to a class of women. It was through one of his pupils that the first woman medical graduate in America became interested in the study of medicine.

In 1846, he communicated to a few liberal-minded professional men his thoughts on the medical education of women, and thereby inaugurated the movement that led to the founding of the Woman's Medical College of Pennsylvania. Though at no time officially connected with that institution, he nevertheless regarded its success with affectionate interest and considered it one of the most important results of his life.

His son, Morris Fussell (1829–1901), after studying with his father, was graduated from Jefferson Medical College and became one of the most successful physicians in and for many miles around Chester Springs.

Dr. Bartholomew Fussell had four brothers, of whom one, called William, had five children. One of these, Dr. Edwin Fussell (1813–1892), was a graduate of the medical school of the University of Pennsylvania, in 1835. He was one of the group attending the meeting called by his uncle, Bartholomew Fussell, to consider the founding of the Woman's Medical College of Pennsylvania. Dr. Edwin Fussell was dean of that college from 1856 to 1866, and during this time he occupied the chairs of histology, practice of medicine, obstetrics and diseases of women. He lived in Media, Pa., and had a son, Linnæus Fussell (1842–1907), also a physician, who likewise practised in Media.

Another son of William, Milton Fussell (1823–1912), in 1848 married Tamar Haldeman. From this union sprang four children. Milton Howard Fussell, the third child, and the subject of this sketch, was born at Belvedere, Chester County, Pennsylvania, November 24, 1855. His given name, Milton, he abbreviated to "M," and was called Howard all his life, except while he served in the army, when, according to military custom, the first name was written out and the second initialed. It seemed

strange to him and his friends to see all official communications addressed to "Milton H. Fussell," but this is the way of the army.

Dr. Fussell's parents were members of the Society of Friends, but as they belonged to different branches of this faith their children were deprived of birthright membership in the Society. Dr. Fussell, however, adhered to the faith of his fathers and joined Race Street Meeting in 1903.

Dr. Fussell's father conducted a small country store, but without much material success. Young Fussell, as Dr. Hamill has stated in an excellent biographical sketch, was compelled to become a wage-earner in his early youth, so as to provide the necessary resources with which to educate himself in the profession of his choice. As his father was unable to help him he had to be satisfied with a limited preliminary education, which he obtained in the public schools of Wayne and the Friends' Central School of Philadelphia. On holidays and during vacations he added to his modest possessions by working in his father's store or elsewhere. After leaving the Friends' Central School, in 1872, he continued to work at many odd jobs, as well as in his father's store, in order to save enough money to pay for his education in the medical school. His few leisure hours were devoted to the study of subjects in preparation for his medical course. Twice each week he walked from his home, then in Radnor, to Villa Nova, to study Latin and Greek under the tutelage of a retired Pennsylvania State Forester. The trip was no hardship to the sturdy youth. It gave him an acquaintance with the wayside flowers and laid the foundation for a life-long interest in botany.

In the autumn of 1875 he entered the medical department of the University of Pennsylvania, but soon found that his hard-earned savings were insufficient to defray the expenses of the entire course. Regretful but undaunted he left the University at the end of the first year and made another and this time successful attempt to better his financial situation. For five long years he taught in the public schools of Radnor, working during

the vacation period at anything that would increase his income. In 1881 he reëntered the medical school of the University of Pennsylvania, wisely electing to repeat the first year, which he had completed five years before. "From the very beginning," writes one of his fellow-students, "he made himself recognized in the class as a superior man." He was easily first in dissection and seized with avidity upon all optional laboratory work and extra courses that were offered. The traits that characterized him in after-life were apparent in his student days: persistent, well-directed effort, a clear head, a good memory; and absence of superficiality in thought and in work. As in later life, he made every moment count, never neglecting an opportunity to increase his knowledge or to widen his experience.

Dr. Fussell's class was graduated in May, 1884, but he was not present at the graduation exercises because soon after the examination and before Commencement, he was seized with what was called "inflammation of the bowels," but which was in all probability appendicitis. It was before the time of surgical intervention in this disease, as the first operation in Philadelphia for appendicitis, credited to Dr. Thomas G. Morton, was not performed until April 25, 1887. In this illness Dr. Fussell was attended by his teacher, Dr. H. C. Wood, and by Dr. George Dock, his classmate and lifelong friend. His life was despaired of; when he came to realize this fact he begged to be married, on what was supposed to be his deathbed, to the woman with whom he had been in love for many long years. The marriage took place, and Sarah Entwistle became his wife. Very speedily thereafter the illness took a turn for the better and recovery soon was complete. From that time until his final illness he never lost a day from work or from recreation through sickness—a wonderful record for one whose work and play were both so strenuous.

In his family relations Dr. Fussell was one of the happiest of mortals. His wife, whom, as I have stated, he had married under romantic circumstances, was an ideal companion for him. Always ready to accompany him on long consultation trips or on night-calls, always thoughtful of his welfare and comfort,

uncomplaining when his hospitality caused him to bring home the unexpected guest, understanding the doctor's troubles and trials, his elation and depression, she grew to be his *alter ego.* When parted from her, as he was for a time during his army service, he wandered about like one of Dante's shades, aimless and unhappy. I can yet see his countenance light up with joy when he received the tidings that Mrs. Fussell was coming to Fort Niagara. To his children, of whom he had four, he was an ideal father—a rare thing for a doctor to be. Although much tried by the illness of his oldest son, upon whom he looked as his successor in medicine, he seldom complained, and until his end maintained a hopeful spirit which I trust may be justified by future events.

Undoubtedly one of Dr. Fussell's outstanding characteristics was his devotion to his family. Never was he too busy to plan something that would give them pleasure. Often, on going home from the University, he would have the carriage with his family meet him in Fairmount Park, and would then ride alongside on horseback, and they would have luncheon together in some quiet spot in the Park.

Another prominent feature was his friendly relation to young doctors. There is scarcely one in the community in which Dr. Fussell practised who could not testify to some kindness extended to him at a crucial moment. For the recent graduates who had the good fortune to be his hospital interns he ever kept open house. Through contact with him they were inspired with his ideals and went forth his disciples.

Dr. Fussell had a remarkable capacity for making friends, not only in the profession but also among the laity. It is impossible to mention his friends by name, but at the time of his death there was probably no medical man among us who possessed a greater number. I might allude here to his friendship with Sir William Osler, which was one of the directing influences of his career. It was, indeed, Dr. Osler who had presented him with his first microscope.

The personality of Dr. Fussell was rugged and simple and had

something Rooseveltian in its boyishness, its enthusiasm and its wholeheartedness. His figure and action betokened strength, and a hardiness of constitution that served him well until the "doctor's disease" laid fingers of steel upon his heart. He was quite stout, so that he looked to be shorter than he actually was. His features were large, his hair and mustache blond until advancing years and overwork turned them gray. There was a smile about his blue eyes that few pictures of him have caught. His laughter was hearty and contagious. It was an honest laughter —never forced—and was a joy to the ear.

Dr. Fussell's mind was not of the type commonly classed as brilliant. His intellect was strong and steady; he was not a variable star—now dark, now shining brightly. In the preface to his book on the *Differential Diagnosis of Internal Diseases*, he states the prime requisites of a good diagnostician as thoroughness, knowledge and tact. "Thoroughness," he further says, "is as necessary as knowledge. Given a brilliant man who attempts to short-cut to his goal of diagnosis, and another less brilliant man who is a plodder, who observes, who looks into each detail, the latter man will inevitably make the better diagnoses and those which will help him most." In this characterization of his ideal diagnostician Dr. Fussell has unconsciously described himself.

Dr. Fussell was tolerant, not in the *laissez-faire* sense, not from a desire to follow the path of least resistance, but in the noble sense of not judging harshly, and, above all, of not prejudging. His ancestry and upbringing had much to do with his temperament, but a big share belonged to his wide contact with humanity. It is this contact that makes the true doctor the most tolerant of men.

Immediately after graduation, in the fall of 1884, Dr. Fussell attached himself to the University of Pennsylvania as an assistant physician in the dispensary of the University Hospital. He soon rose to be chief of the medical dispensary, a position that he filled for many years and in which he acquired the readiness in diagnosis and the facility in treatment that distinguished him

above most of his contemporaries. In 1901 he was made assistant professor of medicine, and in 1911 he was appointed to a new chair —that of applied therapeutics—which he held at the time of his death.

In the performance of his duties he was extremely conscientious. Nothing save the urgent needs of some patient in a crisis deterred him from driving or riding on horseback to the hospital from his Manayunk home. His colleagues, knowing the distance that he had to come, marvelled at his faithfulness in attendance and at his unfailing cheerfulness under the greatest pressure.

The devotion of Dr. Fussell to the University was deep but not idolatrous. When he saw faults he did not hesitate to speak of them. A few years ago, during a time of great commotion in the academic life of the Medical School, when contemplated changes in policy were calling men to range themselves in rival camps, Dr. Fussell espoused the cause of one to whom he felt himself bound in loyalty and friendship. Throughout this troubled period, when men's motives were sometimes questioned, no one ever doubted the singleness of his purpose or the unselfishness of his aims.

Dr. Fussell, being a married man, and having in addition the responsibility of looking after two orphans, did not, as was even in his day the general custom, connect himself as intern with a hospital. Instead, immediately after his recovery from the intestinal disease previously referred to, he opened an office at 189 Green Lane, Manayunk. Practice came to him quickly, for the people soon recognized his unusual gifts as a family physician.

If we could unravel the mysteries of the Caves of the Dordogne and of Altamira we should find that the Cave Man, the towering Cromagnon or the man of Aurignac, when he was wounded or ill turned to someone in the cave for help and gave to him all the confidence of which his primitive soul was capable. And through the countless aeons from those days to this—and no doubt from the earlier time of the Rhodesian and the Piltdown man—the human species has placed its trust in those who made the healing art

their life-work and study. But just as the ancient Hebrews while groping their way through the Wilderness for a time worshipped false gods, so men of a later day have made for themselves idols, at whose feet of clay they have thrown their health and their wealth. Various cults have arisen which flaunt their claims in the market-place. It must be admitted that occasionally these modern bucket-shops of medicine may return a big profit; but in the long run man will find it safer to trust his capital of health to that medical banking house which has its foundations back in the beginnings of time, when men began to stand upon their feet and to speak one unto the other. Of that noble medical banking house, with its immemorial history, Dr. Fussell was a member, and one of the best. With what confidence would the father and the mother come to him and bring their burdens, feeling that, within the limits of human capacity, their lives and those of their children were safe in his hands. He knew the limitations of the single mind and understood intuitively when to take occasion by the hand and call upon others for help. That knowledge, combined with a realization of his tremendous responsibility, the weight of which few laymen fully appreciate, influenced his attitude toward surgical operations. To him surgery was one of the modes of treating disease to be used when necessary or advisable. Naturally, therefore, he was neither timid nor rash in calling upon the surgeon. Few men have I known whose minds in that respect were equally well balanced. All these qualities of mind and heart made him a tower of strength, a haven of safety, a family physician of the ideal type, than whom the imagination of Ian McLaran or Balzac could create no finer example.

There are some who believe that the species of family doctor will soon become extinct; that before long he will have to be searched for like the plesiosaurus of Patagonia. However, if I may express my personal opinion, I would say that this is not the trend of evolution. (Until we take our science from Kentucky and our cosmic philosophy from Nebraska, the word "evolution" may still, I trust, be used.) Instead of facing extinction the family doctor will become a mightier and a safer counsellor as

medical knowledge increases. He will steer the family ship of health, but for certain specific duties and performances he will call—and will know when to call—upon men specially trained.

Much of Dr. Fussell's practice consisted in his earlier years in performing the duties of an obstetrician. He had so much work in this line that he eventually became recognized as an expert accoucheur. Progressive in this field, as in all others to which he devoted his talents, he was one of the first to make use of bacteriology in the diagnosis of infective conditions. There were not then, as there are now, laboratories in every hospital, besides innumerable private laboratories. Dr. Fussell was compelled to make his own cultures and do his own laboratory work. He did this willingly, for it would have been impossible for a man of his character to neglect to do anything that could help his patients.

In the early years of his practice, at a time when "race suicide" had not reached the remote section of the city in which he dwelt, Dr. Fussell also had a very large practice among children. This was before the days of antitoxin; and it was a common occurrence for him to sit up all night at the bedside of a child suffering with diphtheria or croup. Many cases were saved through his devotion; many he could not save; but the trust he inspired and his words of consolation rendered the burden of grief more easily borne, the parents feeling assured that nothing within the scope of human endeavor had been neglected.

For twenty-five years Dr. Fussell practised at his original location in Manayunk. Then he moved to a larger house in Roxborough, where he lived until his death, a period of twelve years. In the course of time his work as a consultant became so onerous that he was forced reluctantly to give up his family practice. In order to suit the convenience of those seeking his skill he opened an office in the central part of the city, in conjunction with his friend, Dr. Alfred C. Wood.

As a consulting physician he was in great demand, not only because of his skill as a diagnostician and his resourcefulness in the crises of disease, but also because he brought to the bedside a

scientific spirit with which he inspired the men who called him to strive to do better work. Whenever and wherever possible he urged the use of the laboratory in clinical medicine. In his familiar black bag he carried the things needed for the simpler laboratory investigations, and he shirked no labor in order to put his preaching on that score into practice. This phase of his medical activity appealed strongly to Dr. Osler and formed a bond of affection between the two men. Dr. Fussell's attitude toward the laboratory was that of the true clinician; of one who has no desire to throw the whole burden of diagnosis upon the laboratorian, but who thoroughly and conscientiously studies the patient and his history and then resorts to the laboratory for confirmation or disproval of his findings or for such additional information as may be of help in diagnosis or treatment.

As a teacher of medicine, Dr. Fussell's status was unique and most enviable. Without conscious effort on his part he became, from the point of view of popularity among the students, *facile princeps*. Medical undergraduates, as some of my hearers know, are the keenest of critics. By some sort of crowd intuition they quickly sense the genuine in an instructor—or the spurious if it exist, no matter how well it may be concealed. Year in and year out the classes attending the University quickly picked out Fussell as a man without a flaw. To all he was "Daddy Fussell," the admired, the beloved, the trusted teacher and friend.

I need not speak in detail of his teaching. It was simple, practical and exceedingly helpful, by reason of his enormous and well-considered experience. He imparted not only the technical knowledge of which he was master, but also those traditional principles of honor and fair-dealing, both among medical men and toward the laity, which he illustrated in his daily life as but few have done. An interesting feature of his practice and his teaching was his unconcealed antipathy to proprietary and patent medicines. Many of us have seen him bring a market-basketful of "samples" to a lecture on this much discussed theme.

In order to teach and to write, Dr. Fussell took time to keep up with the main currents of advance in medical literature. How he found time to do it was a mystery to his contemporaries. With a unique *flaire* he was able to pick out the real improvements in medicine and to adopt them in his teaching and in his practice. Realizing better than some of our young men of today the importance of foreign languages as a key to the world's thought, he mastered German and French sufficiently to be able to read them with comparative fluency. Greek and Latin he had studied in his earlier years. There is thus presented in this modest doctor a solidity and breadth of learning that one is accustomed to look for only in the college-bred man.

The literary output of his life is remarkable when one considers the unceasing professional pressure upon him. It is after all only the busy man that has time to do many things. Dr. Fussell's contributions comprise numerous journal articles on subjects of practical medicine—a few written in collaboration with others, but the majority the products of his own active pen. His *magnum opus* is a work called the *Differential Diagnosis of Internal Diseases,* a large volume dedicated to his wife, in which he recorded the results of his experience as a medical practitioner. He also had a large share in the later editions of Dr. Tyson's well-known book on the *Practice of Medicine,* and his name appears as a co-editor on the title page. While the *Differential Diagnosis of Internal Diseases* is his literary monument, his greatest achievement, unfortunately, is buried with his bones—his extraordinary diagnostic acumen, which made him one of the most popular consultants of our time.

Dr. Fussell held many offices. At one time he was physician to St. Timothy's (now the Memorial) Hospital, of the staff of which he was chief. He was also connected with the Chestnut Hill and Episcopal Hospitals. For a term he was president of the Pathological Society of Philadelphia and chairman of the medical section of the Pennsylvania State Medical Society. He founded and was president of the Twenty-first Ward Medical Society. A position of which he was very proud was that of

chairman of the Social Service Committee of the University Hospital. He was a member of the board of directors of the Roxborough Home for Indigent Women, a member of the council of the College of Physicians of Philadelphia, and was active in the affairs of the University's medical school in China. He was also deeply interested in the Visiting Nurse Society of Philadelphia, one of the most useful of the city's charitable agencies. As chairman of its advisory committee he proved, through his tolerance and sound judgment, of immense value to the society and helped to broaden the scope of its work.

The duties of all these positions he fulfilled while attending punctiliously to those connected with his professorship of applied therapeutics in the University of Pennsylvania and while answering the demands of an enormous practice. How he did it never ceased to be a wonder to his friends.

Like all sensible men, Dr. Fussell had his hobbies and "knew how wisely to lose time." He was fond of photography, of horses and of gardening, and, as I have said before, was devoted to the study of botany, which he pursued with more than an amateur's zeal. Deep and lasting was his love of travel and of outdoor life. It was partly his desire for travel and partly his love of his profession that made him a faithful attendant at medical conventions. He did not himself indulge in athletics or sport to any great extent, with the exception of swimming, but he was passionately fond of witnessing football and baseball games, especially when the team of his *alma mater* was one of the contestants.

Like most mentally strenuous men, Dr. Fussell was fond of detective stories, although Dickens, Thackeray and Shakespeare were his best literary friends—a good selection for one who had at his disposal so little leisure time.

Dr. Fussell in his outlook upon world affairs was an American in the true, the spiritual sense of that word. Although endorsing the war and participating in it, he held in the main those altruistic principles that have made the men of his sect messengers of peace and succor to the unhappy countries of Europe. In politics

he was a staunch Republican, but his party fealty never deterred him from espousing the cause of reform in local government.

Toward the end of June, 1917, I was one day called on the telephone from Washington by the late Dr. Theodore Janeway, and asked to gather together a group of medical men who would be willing to volunteer for special service in the army. Dr. Fussell was one of the first to whom I appealed, not realizing that he was sixty-two years of age. His ready answer was, "If you go, I will go." Dr. Fussell and I were sent, Dr. A. A. Eshner forming the third member of our party, to Fort Niagara. Dr. Fussell, now Captain Fussell, did his work so well that within a few weeks he received from the Surgeon-General the offer of a major's commission and of the chiefship of a hospital. This offer, however, he felt he could not accept.

From Fort Niagara he was transferred to Gettysburg, where he became the inspiration as well as the titular head of a very much larger board that in the course of a few weeks examined nearly eight thousand men. From Gettysburg he and his two collagues were called to Fort Niagara to examine the men of the Second Officers' Training Camp established there. It was at this time that the only unpleasant incident of his army experience occurred. One of the officers' houses had been assigned to him and Mrs. Fussell. There they established a happy household, having been joined by their daughter, and having been gracious enough to invite the writer into their home as guest. One day a young West Point captain and his wife arrived in camp the adjutant without a word to us bestowed upon the newcomers the quarters that we occupied. Dr. Fussell was exceedingly provoked and in the privacy of the family circle uttered very plain speech, not altogether the speech of the plain people, concerning the incivility of headquarters. The commanding surgeon of the post, who had become an ardent admirer of Dr. Fussell, was even more indignant. Being from the South and having served long in the army, he was able so to ornament his speech that within a few days proper amends were made. By that time, however, Dr. and Mrs. Fussell had rented a house in the village, where they lived until our service at Fort Niagara was ended.

I cannot refrain from telling you of an amusing incident of our life at Fort Niagara: One day we three men were walking toward the village as a number of companies were coming back from a day's hike. No sooner had they spied us than they began to call out, "Ninety-nine! Ninety-nine! Ninety-nine!" the words that we had made them say during our examination of their lungs. These words were taken up by rank after rank and company after company. They all marched past us to the refrain of "Ninety-nine! Ninety-nine! Ninety-nine!" much to their amusement as well as our own.

I recall another amusing picture of Dr. Fussell's army career. While at Gettysburg he took part in a dance, and I can still see him clasping his wife tightly and smiling the smile of a happy boy, as, with elephantine lightness, he negotiated the four sides of the large reception hall in the Pennsylvania Academy.

Many years before he volunteered for the Army he had given concrete evidence of his readiness for public service. At the time of the Johnstown Flood he had gone, at great personal sacrifice, to that city, and had given his services during the harrowing days of that terrible catastrophe. There is still in the possession of his family a certificate given to him at the time in appreciation of his work.

Dr. Fussell, like many of his profession, died of angina pectoris. The first intimation that there was anything wrong with him came in the spring of 1917, when he consulted Dr. Zentmayer on account of failing eyesight. Dr. Zentmayer found some sclerosis of the bloodvessels of the eye and a considerable degree of retinal edema. Although realizing fully the significance of these findings, Dr. Fussell refused to change his mode of life, declaring that he could not and would not do so. His first actual attack of heart pain occurred at Fort Niagara, in the summer of the same year, under the following circumstances:

One night three of us were walking together toward the reservation, when Dr. Fussell suddenly dropped behind. As he did not rejoin us in a few minutes I went back to look for him. I found him leaning against the corner of a house and holding his

hand tightly over his heart. It needed no exchange of words between us for a realization on our part of what had taken place. I was much concerned about him, but although I tried to talk to him of his health on several different occasions, he always evaded the subject. So well did he conceal his affliction that neither his family nor his friends suspected its existence. Not until July, 1921, did he tell his wife that he had had heart attacks, and the other members of the family knew nothing about them until after Labor Day of last year, when his son saw him in an attack of pulmonary edema. Then at last did he admit that he had suffered with anginal attacks for four years.

Although again warned, he would not spare himself, and even during September he worked as hard as always. His friends, however, had noticed for some time that his face had the drawn and weary look of one who suffers and knows the cause and nature of his suffering.

On October 15 he was called in consultation to Lock Haven. Immediately after beginning his return journey he was seized with an attack, and when the train reached Williamsport, the running time between Lock Haven and that point being only half an hour, he was dead.

At the funeral services, held in his Roxborough home, the high and the low assembled. Physicians in large numbers came out from the city and from considerable distances beyond. Nurses, former students, interns and others stood about in hushed groups. Patients and neighbors filled the house and lawn. All realized that a fine and noble man had gone forever.

Owing to a detour we had lost our way to the house, and on inquiring of an ice-man, "Where is Lyceum Avenue?" he said, "You are going to Doc Fussell's. I will show you the way." This reply, in its familiarity of language and tone, well indicated the place our friend had held in the hearts of the people.

Dr. Fussell leaves behind him a name that all might envy. His life was hard but happy—happy in the affection of his fellows and in the love of his family. As she whose loss is greatest said in a recent letter, "He had everything in the world that he could wish for except to live a little longer."

MEMOIR OF DR. CHARLES WINSLOW DULLES.[1]

By JAMES HENDRIE LLOYD, M.D.

Dr. Charles Winslow Dulles, a former secretary of the College of Physicians, was born at Madras, India, on November 29, 1850. His father, Rev. John Welsh Dulles, was a missionary, and had been sent out to India by the American Board of Commissioners for Foreign Missions. He had six sons, two of whom became prominent in the church, and one of them, Rev. Joseph H. Dulles, has for many years been librarian of the Theological Seminary at Princeton. Their mother's maiden name was Harriet Winslow. The Winslows were also a well-known missionary family, and Dr. Myron Winslow, the maternal grandfather, had been a missionary in India for forty-five years.

On the mother's side, Dr. Dulles was descended from Elder William Brewster, who was one of the leaders of the Pilgrim Fathers on the voyage over in the *Mayflower*. Of this descent he had just reason to be proud, and he was active in the affairs of the Society of Mayflower Descendants.

If we are to accept the doctrine of heredity, as now set forth by the Mendelians, we can easily see in this noteworthy genealogy the traits of the descendant. Those traits, which we all recognized in Dr. Dulles, such as his adherence to conviction, his rather uncompromising way with his critics, his strong moral sense and his quick insight in debate, were such as might on occasion have been made manifest by Elder Brewster, of Plymouth Colony, or by the missionary who braved a voyage of five months to carry what he believed to be the right religion to the Hindus.

[1] Read October 4, 1922.

When the son was not three years old his parents returned from India to America, and he grew up and spent most of his life in Philadelphia. Of his schooling I have found no record. He entered the college of arts of the University of Pennsylvania, but did not finish the course, and for a while engaged in business. But he must have felt that his true calling was in a profession, and he again entered the University, in the Medical Department, and took the degree of M.D. in 1875.

On his graduation Dr. Dulles won a notable honor. His thesis, on "Suprapubic Lithotomy," was awarded the alumni prize of one hundred dollars. I have the best surgical authority for saying that it was this paper which really aroused interest in that operation and had a wide influence in its revival both in this country and abroad. The paper was quoted by Gross, and noticed favorably by other eminent surgeons. It was published, in condensed form, in the *American Journal of the Medical Sciences* for July, 1875, and comprised a history of the operation from its earliest use, with a table of 478 cases. It showed literary and scientific merit of a high order, and conferred a distinction on its author which is rarely attained by the work of an undergraduate. It also showed Dr. Dulles's early bent toward surgery, a field of practice which always engaged his attention and in which he was to win still further literary success.

After his graduation Dr. Dulles went to Europe, where he studied in Vienna, Paris and London. When he returned he settled in West Philadelphia, where he practised for more than forty years. He became consulting surgeon to the Rush Hospital, a manager of the University Hospital, and a member of numerous learned societies, among which were the American Association for the Advancement of Science, the Society of American Authors, the Philadelphia Academy of Surgery, and the College of Physicians. He was secretary of the College from 1891 to 1895, during the presidencies of Dr. Agnew, Dr. Weir Mitchell and Dr. Da Costa.

In 1886, Dr. Dulles read before the College his paper on "Mechanism of Indirect Fractures of the Skull," which appears

in the *Transactions* for that year. The subject was presented in an original way and illustrated with a large number of diagrams, which give it permanent value. These are now deposited in the library of the College. This paper, like his earlier one, brought him much favorable notice.

From 1887 to 1890, Dr. Dulles was editor of the old *Medical and Surgical Reporter,* a journal which for many years had flourished in Philadelphia. This office he filled with ability. In looking over the bound volumes of the *Reporter* one is inspired with some pleasant if rather melancholy reflections. These volumes recall the medical life and activities of the city as they were in evidence more than thirty years ago. Its columns abound with the names and writings of distinguished members of the profession, many of whom have now passed on, while others, who are still with us, were making their earlier bids for fame. Medical journalism has now so almost completely disappeared from Philadelphia that there is a special interest in recalling the existence of an old-time medical journal which forms one of our traditions. Time was when Philadelphia had its weekly medical journals, sometimes as many as three of them, and when it would have been thought that we could no more do without them than without our daily newspapers. They kept alive our local spirit, our self-consciousness, our professional pride, and sometimes our professional rivalries. They were redolent of the place, and at the same time they reminded the world of our existence. But times have changed; our Saturdays are no more enlivened by the editorial sallies of Gould, of Dulles, and of other aspiring chiefs of the sanctum; and this old town must now look for its weekly bill-of-fare to Chicago. Perhaps the change was inevitable; medical journalism had become an expensive luxury; competitors in other cities were numerous; but we older men cannot recall without at least a sentimental regret the days when we had our own spokesmen. In this galaxy of editors Dr. Dulles filled an honorable place, and is worthy of being remembered by an inedited generation.

Dr. Dulles once led in a controversy about hydrophobia. He had formed the opinion that most, if not all, of these cases were

spurious, and, to use his own words, he wrote "many papers designed to allay popular fear and correct professional error in regard to so-called hydrophobia." Before the time of Pasteur the confusion in the popular, and even in the professional mind, on the subject of rabies, was great; but neurologists had long known that the mere dread of this mysterious thing was often the cause of serious mental and nervous disorders. The word "lysso-phobia" was used for this counterfeit, and Tuke's dictionary even called it "hydro-phobo-phobia," which indicated an accumulation of fears enough to upset any nerves. The text-books recognized it, and among the causes of hysteria they usually included the bite of a dog. This was so particularly in France. Cases of "lysso-phobia" cropped out every once in a while, but the newspapers usually made a sensation of them. Osler reported a case in a young man, who, having been bitten, was teased about it by his comrades until he was thrown into almost a mania of fear. Dr. Mills published a paper on "Cases with Hydrophobic Symptoms," and his opinion was that the vast majority of cases reported as hydrophobia were nothing of the sort, but were cases of meningitis, tetanus, or some unknown toxemia, or lysso-phobia. He treated some of the hysterical victims and cured them by psychic methods. Sometimes epidemics occurred, which could only be explained as instances of pandemic hysteria. One of these, reported in Vienna, drew forth a trenchant letter from Dr. Dulles to the *Public Ledger*. Eighty cases had occurred, with only eleven deaths, and it was pertinent to ask why the mortality was so low in an epidemic of a disease which was at that time uniformly fatal. But, on the other hand, he overlooked the fact that a mortality of eleven out of eighty cases was too high for hysteria.

There were mad-dog doctors in those days. The late Dr. Hiram Corson, of Montgomery County, who graduated away back in 1828, wrote an amusing account of some of these gentry. When anybody was bitten by a dog he was hurried to one of these fakirs, who straightway cured him of a disease which he did not have. They used formulas which had been handed down from generation to generation, and which read as though they came

out of the Middle Ages. But who shall say that they did no good? They probably saved many a rustic from a bad attack of hysteria, and even from being smothered to death under a mattress held down by six or eight men. Such things actually occurred and are recorded.

In trying to define Dr. Dulles's position it is well to recall that Pasteur's earlier announcements were received with widespread scepticism. This is the penalty paid by many a pioneer, but Pasteur's rather loose statements, and especially the methods of gathering statistics at the Pasteur Institute, made him a rather vulnerable foe. Dr. Dulles evidently did not think that to gather together all persons bitten by dogs, to give them a novel and untried treatment, and then to announce that they had been saved from rabies, was scientific; and there were not a few physicians who shared his doubts. The *New York Medical Record,* in an editorial, severely criticized the Pasteur Institute which had been set up in that city. Hardly a day passed, it said, that the papers did not contain accounts of alleged mad dogs, and of the setting out of their victims to the branch Mecca of Pasteurism in New York. It claimed that many of these cases were mere instances of fright, and that the establishment of such an institution in this country was unfortunate and productive of incalculable mental anguish.

In such an atmosphere of doubt the more cautious preferred to keep silent, to adopt a waiting policy, to hope and even to believe that Pasteur would be found to have made a great discovery; and this course has been justified by the event. But Dr. Dulles was not one to keep silent when he believed that he saw an evil, and his pen and voice were soon active.

I have not time or space, nor shall I be expected, to follow this discussion in detail. Dr. Dulles's best paper on the subject was probably the one he wrote on "Diseases Mistaken for Hydrophobia," in which he pointed out the grounds for a differential diagnosis. It contained an extensive bibliography, which is of value to the student of medical literature.

Dr. Dulles was well fitted for a discussion of this kind. He

had a ready pen, a studious habit and the courage of his convictions; and however widely his opponents may have differed from him, they must have felt that he made things interesting for them, as he also did for those of us who were mere spectators of the fray. Although I was one of those who were not in entire accord with his views, I feel at this distance of time that the discussion was followed by some good results, which are even yet evident. It served to clear the subject of some obscurities, to rob it of some of its appalling uncertainties, and to point out how the counterfeits of the disease were often the cause of popular error and excitement.

Our knowledge of hydrophobia is now more securely fixed on a scientific basis, but in former years, before the work of Pasteur and others, the disease was often a subject of mystery and popular misapprehension, as will be evident to anyone who cares to read up on the weird subject of lysso-phobia and hysteria. The genuine disease is now most rare. According to the records of the Department of Public Health there have been but twelve deaths in the last ten years in Philadelphia, while lysso-phobia seems practically to have disappeared. I do not recall having heard of a case in recent years. This is due to our scientific knowledge both of the real disease and its imitators. To this result the writings of Dr. Dulles contributed.

Dr. Dulles was criticized for denying, as was charged, the existence of hydrophobia; but his papers make the impression on the reader of today that he was intent rather on correcting errors about the disease than on denying its existence. He had long ceased to write on the subject; and although I have no means of ascertaining now what his later opinions were, I think it may safely be assumed that he had come to recognize the distinction between the genuine disease and the spurious forms of it which had originally engaged his attention.

The controversy has now merely a literary and historic interest. Dr. Dulles's papers were no doubt aggressive and somewhat provocative; they were written in a clear and incisive style that was characteristic of him; and they may be consulted by the

future student of hydrophobia who wishes to inform himself about a phase of the disease and its counterfeits which was once thought to have more importance than it now possesses.

For some years Dr. Dulles was lecturer on the history of medicine in the University of Pennsylvania. He wrote an interesting paper on the "Charity School of 1740," in which he aimed to prove that the University took its origin in that primitive school and at that date. He was also the author of *A Manual of Accidents and Emergencies*, which went through eight editions; but a book which has gone through eight editions needs no eulogist.

He was married in 1881 to Mary Bateman, daughter of a well-known merchant of Philadelphia, and had three sons and a daughter, who with his widow survive him. He died on May 6, 1921, in his seventy-first year, after having suffered from, and borne with equanimity, an affection which for some time had partially disabled him.

Dr. Dulles was a man of marked individuality. He was always himself, and did not belong to the type of standardized Americans which the present age tends more and more to produce. A mutual friend has called him "a most interesting character"; and like all unusual men who preserve their identity in the crowd, he had his critics, whom he always seemed to suffer gladly; but he also had his friends, who enjoyed his company, who knew how to estimate him, and who will join in this short tribute to his memory.

THE ANNUAL ADDRESS OF THE PRESIDENT[1]

By WILLIAM J. TAYLOR, M.D.

In making this my third and final annual address as your presiding officer, I wish to thank the Fellows of the College for the great honor they have done me in electing me their President for the past three years, and to express my appreciation of the confidence they have had in me and to thank them for their cordial support and courtesy.

Business of the College. I regret to say that we have been compelled to return to the executors and trustees the legacy of five thousand dollars bequeathed to the College by the late A. Haller Gross to be used for the purchase of books for the Samuel D. Gross Library. It was found, on investigation, that Mr. Gross's death occurred six hours before the expiration of thirty days from the signing of his will, and, as the Courts decided that the College is under the law a charity, this bequest was not operative, and it was therefore returned.

The finances of the College are in excellent condition, and while our total income is large, much of this is derived from special funds which can only be used for special purposes. This leaves the amount available for general expenses, salaries and upkeep less than we need. Careful economy, however, in spite of the high cost of everything, both men and materials, has enabled us to end the year free from all debt.

Concerning the Scientific Business. In addition to the nine stated meetings of the College there have been three special

[1] Read January 4, 1922.

meetings and five meetings at which special lectures have been delivered. Three of these were Mary Scott Newbold lectures, one a Nathan Lewis Hatfield lecture, and one a Mütter lecture.

At the stated meeting on January 5 a memoir of the late Dr. James Tyson was read by Dr. M. Howard Fussell, now unhappily passed from us, and a memoir of the late Dr. J. Ewing Mears by Dr. Richard H. Harte.

At the April 6 meeting a memoir of the late Dr. George S. Gerhard was read by Dr. Francis R. Packard. At this same meeting Prof. F. G. Hopkins, of Cambridge University, read a paper upon "Some Oxidative Mechanisms in Living Tissue."

At a special meeting, May 23, 1921, Dr. Robert Abbe, of New York, an Associate Fellow and an ever-generous friend, presented to the College a cabinet, to be called the "Custodianship Case," with mementos of Lord Lister and of Louis Pasteur, together with a fund of five thousand dollars to be used for its maintenance and increase. At the same meeting Marie Curie presented to the College a Quartz-Piezo electrometer designed and used by her and her husband in their early work of measuring the radio activity of radium. Madam Curie, placing her hand upon this instrument, said, "I am glad to present this instrument to so distinguished a society."

At the meeting of December 2, Dr. Abbe presented some test-tubes containing the dried sterile milk which Lord Lister had used in his earliest experiments in fermentation. This is peculiarly valuable as a memento and was given to Dr. Abbe by Sir Rickman Godlee for presentation to the College.

Three Mary Scott Newbold lectures were delivered during the year: Lecture No. 4, by Major General M. W. Ireland, Surgeon-General of the U. S. Army, on February 4: "The Achievement of the Army Medical Department in the World War." Lecture No. 5, by Prof. William Romaine Newbold, on April 2: "The Voynich Roger Bacon Manuscript." Lecture No. 6, by Lieutenant-Colonel Robert McCarrison, of the Indian Medical Service and Fellow of the Royal College of Physicians: "Some Effects of Faulty Food on the Endocrin Glands."

The Nathan Lewis Hatfield lecture was delivered on February 18 by Dr. William R. Nicholson: "The Midwifery Situation."

The Mütter Lecture was delivered by Prof. H. C. Jacobaeus, of Stockholm, Sweden, at the November 2 meeting: "The Surgical Treatment of Tuberculosis of the Lungs."

It is well to mention the meeting on November 30, under the auspices of the Section on Medical History, to which all of the medical students in Philadelphia were specially invited. Addresses were made by Dr. H. R. M. Landis, John H. Gibbon, David Riesman, J. Chalmers Da Costa, Charles W. Burr, and Thomas McCrae, describing many of the older French and English teachers of medicine. This meeting was much appreciated by the students and practitioners who were present and was most instructive.

The scientific value of the papers and addresses presented to the College has been of a high order and the interest shown by the Fellows and general medical public has been most gratifying.

The College is greatly indebted for a bronze bust of Dr. Louis Starr, long an honored Censor of the College, which was presented by Mrs. Starr. This has been placed in the Hall, near the entrance to Mitchell Hall, and is a worthy addition to our collection of portrait busts of distinguished Fellows.

Concerning the Revision of the By-Laws. The Committee upon the Revision of the By-Laws has completed its labors and the presentation of its report to the College only awaits the opinion of legal council as to the wording of certain of the suggested amendments.

Concerning the Council. The Council has with fidelity performed the duties imposed upon it. All matters referred to it by the College have been considered and many items of business have originated in the Council and been recommended to the College.

Our thanks are due to the officers and members of committees.

Mention must be made of the faithful and efficient services rendered by the Librarian and Superintendent, Mr. Charles Perry Fisher, and of Miss Zelner, the Clerk of the College. To both our thanks are due.

Concerning the Library. The total number of volumes now in the Library, including bound volumes and 17,760 unbound *Reports* and *Transactions*, is 130,220. The number of unbound *Theses* and *Dissertations*, 12,568. The number of unbound pamphlets, 127,956. Included in the above are 3828 volumes of reserve copies of the more important periodical publications and 3016 volumes more or less incomplete. Duplicates, not included in the above total, number 8714. During the year there were received from all sources 4854 volumes, 19,186 pamphlets and 10,768 numbers of various periodicals.

Our list of portraits of medical men now number 10,046.

In the report of the Library Committee will be found a list of rare books and works of special interest received during the year. The Incunabula numbers 305 titles and 287 volumes.

We have also received an interesting holograph letter from John Hunter, dated December 11, 1791, addressed to Edward Jenner. Presented by Dr. Morris J. Lewis.

The total of the Library Endowment Funds at this date is $357,497.02.

Concerning the Hall Committee. All necessary repairs have been made and the property is in good condition, and during the year many of the portraits have been restored, as they showed evidence of wear and deterioration, but owing to the high cost all could not be done. It was also found impossible, for lack of means, to carry out the direction of the College to erect a tablet to contain the names of Fellows who served in the Great War.

Concerning the Committee on Publication. Owing to certain unforeseen circumstances and many vexatious delays in securing manuscript from speakers from out of town, together with the printers' strike, the volume of *Transactions* for 1920 was late in being issued. It is a much larger volume than usual, as it contains not only the scientific papers read at stated meetings but presents a complete record of the work of the various sections and the interesting and valuable memoirs of the late Dr. H. C. Wood.

Concerning the Work of the Sections. The scientific work of the various sections has increased very much during the past few years and will progress still more as time goes on, and the papers read are of such value that it is hoped that full records of their proceedings can be printed in our annual volume of *Transactions*.

Papers on subjects of interest to the specialties are being read at the meetings of these sections, allowing the stated meetings of the College to be devoted to matters of general interest.

Owing to the greatly increased number of meetings it has been decided, as far as this is possible, to arrange for the lectures of the various foundations, the Mütter, the Nathan Lewis Hatfield and the Mary Scott Newbold lectures, to be given at the regular stated meetings of the College and thus reduce the number of special meetings.

During the year the College has lost by death seven Fellows:

Dr. Walter J. Freeman, who died on December 20, 1920, after a year of suffering very patiently born. He was born in Beverly, N. J., in December, 1860, and entered the College of Physicians and Surgeons in New York in 1881. His last year in medicine was spent in attending clinics and lectures at the University of Pennsylvania, traveling back and forth almost daily between Philadelphia and New York. He graduated from both schools of medicine in 1885. After three years of study spent in Europe he settled in Philadelphia and devoted himself to otolaryngology and soon was recognized as one of our leading specialists. He was elected a Fellow of this College in 1890.

Dr. William M. Welch died on February 8, 1921. He was widely known as an authority on contagious diseases. He graduated from the medical school of the University of Pennsylvania in 1859 and served in the Civil War, at Gettysburg, and in the hospitals at Chestnut Hill. He was a former president of the Philadelphia County Medical Society and of the Pennsylvania State Society, and was elected a Fellow of this College in 1883.

Dr. Charles W. Dulles died on May 6, 1921, and was one-time Secretary. A memoir will be prepared later.

Dr. Charles H. Thomas died on June 28, 1921, having been incapacitated by illness for many years.

Dr. Walter L. Pyle died on October 8, 1921.

Dr. M. Howard Fussell died suddenly on October 15, 1921. He will be a great loss to the College, in whose proceedings he took a very active interest and was a member of the Council at the time of his death. A memoir will be prepared later.

Dr. J. Morton Boice died on December 2, 1921. He rendered faithful service as secretary of the Philadelphia County Medical Society and was a member of many medical societies.

During the year nineteen Fellows were elected, one resigned and one forfeited his Fellowship.

The roll of the College on December 1, 1921 includes: Fellows, 482; Associate Fellows: American 13, foreign 6; corresponding members 6; total 507. Of the 482 Fellows, 435 reside in Philadelphia or its immediate vicinity in Pennsylvania, the remaining 47 are nonresidents.

THE VARYING CHARACTER OF PROSTATIC OBSTRUCTION[1]

By ALEXANDER RANDALL, M.D.

I do not believe it is necessary in this day and before this audience to draw for you the typical picture of a man suffering from advanced prostatic obstruction. Prostatism we call it. But I will ask you, just for the very moment, to reflect in your mind such a picture, one that I know you have all seen, with the dysuria, frequency, pain, loss of sleep and general discouragement with life. Then picture, if you will, that same individual as he must have been at forty-five years of age—robust, vigorous and in the prime of his endeavors. Somewhere between these two pictures must lie a period of gradually increasing bladder obstruction. During these years the slow, insidious growth has been causing normal functions to become abnormal; these abnormal functions have been working against the vitality of a vigorous man; difficulty of urination has caused bladder hypertrophy; this in turn has caused increased intravesical pressure; somewhere following this the bladder wall has weakened and residual urine has started, causing greater pressure in the ureters and in the renal pelves; higher intrarenal pressure then becomes necessary; blood-pressure mounts and cardiac embarrassment follow. "Old age is creeping on apace." (Byron.)

This is the picture that we, as urologists, have in our mind as having transpired whenever such a clinical case presents itself, and our endeavor in handling such is to reverse the entire train

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of events by proper bladder drainage. Infection simply complicates the picture and treatment.

It is but a natural conclusion to realize that there must have been existing during this period a train of minor symptoms and signs that pointed to the pathologic changes which were transpiring, and their early recognition and rectification would be a brilliant step in preventive medicine.

It was with this view in mind that eight years ago I began studying the bladder and prostate from each case autopsied at the Philadelphia General Hospital, and am now just rounding out 900 specimens.

The greater part of our knowledge of prostatic pathology has been acquired by the intensive study of clinical material both before operation and from specimens removed at the operating table.

Progress based on clinical study alone, either diagnostic or surgical, is a poor foundation and liable to lead one into erroneous conclusions. We must always go back to the bread and butter of "gross" pathology as reviewed at the autopsy table for fundamental structural changes no matter how appetizing the relish of "living" pathology is. It is bad for our digestion as a steady diet. Let me illustrate what I mean: No less a surgeon and skilled urologist than Freyer has drawn faulty conclusions from clinical material alone, for in the latest edition of his treatise on *Prostatectomy* (1920), and with a clinical experience surpassed by none in doing over 1600 prostatectomies, he still categorically states that there is no such thing as a third or middle lobe to the prostate. I can readily see how he should arrive at such a conclusion on operative evidence, believing, as he does, that it is but a pathologic outgrowth of one of the lateral lobes; but the microscopic studies of Lowsley have proven him incorrect and the gross specimens I will show you this evening of early solitary median hypertrophies, taken in some cases before symptoms occurred, will allow of no other conclusion than that he (Freyer) is in error.

My studies have shown that, speaking broadly, there are three

different types of changes to be met with in this gland that can cause vesical obstruction, and when confronted by such a clinical picture as one suffering from prostatism it is incumbent upon the surgeon to make a differential diagnosis, for the proper handling of the individual case is entirely dependent upon the proper appreciation of the individually existent cause.

In their purity these three obstructive changes are (1) a benign glandular hyperplasia, (2) a fibrosis (median bar formation) and (3) malignancy.

Ciechanowski and Albarran abroad and Watson and Lowsley in this country are the only ones who have sought the autopsy table for a series of specimens and based their valuable conclusions on the gross and microscopic study of the material there found. In my series, now approaching 900 autopsies, all ages have been examined, though, of course, the majority in their elder years, and this material has been mounted, drawn or photographed. The question immediately springs into your mind, How did you know that these patients suffered from urinary obstruction during life? Wade says:

"How often during the postmortem examination of patients who have died of various diseases in the medical wards of the hospital there can frequently be observed, in male subjects over the age of fifty years, indications of a mild degree of chronic prostatic disease with associated damage to the urinary tract above. It is virtually always found that no complaint has been made of this by the patient. It is usually unsuspected and has virtually never received treatment. In these cases, however, the ureters and renal pelves are dilated to a moderate extent and there is present a recent interstitial nephritis throughout both kidneys, and the renal parenchyma shows indications of pressure atrophy through its substance. When the pathology of these cases is reviewed by one with a surgical mind it is possible to avoid the conclusion that the renal destruction, as a result of the partial retention of urine from the prostatic disease, has contributed, to a certain extent, to lowering the patient's power of resistance to a general infection or has poisoned the heart muscle

by the retained products of metabolism which should be normally excreted by the healthy kidney."

Added to these renal changes the outspoken pathology that exists in the trabeculated bladder wall, the dilated ureters, the deep bas-fond formation, perhaps a diverticulum or two and your circumstantial evidence of vesical obstruction is so complete as to be beyond argument. In the majority of my cases these stigmata have been so self-evident as to demand explanation rather than inquiry, and as an actual matter of fact these, and only these, are oftentimes the signs and symptoms which we use cystoscopically to diagnose the obstructive nature of prostatic lesions. These patients have succumbed to other lethal affections, and their clinical and anatomicopathologic diagnoses rarely take into account the part played by the urinary obstruction. These are the evidences that I have taken as indicative that the pathologic changes found at the vesical orifice did actually cause urinary obstruction during life. The part played by this obstruction in the individual's death has frequently presented a beautiful sequence of easily deducted events where it has been possible to see it, both from the experience of the postmortem examinations and the training from clinical observation. What I mean to convey is this: That clinically we frequently see an old prostatic verging on uremia, with weakened myocardium and chronic interstitial nephritis, pick up under treatment, withstand operation and live on to years of health and comfort, oftentimes better and stronger than for years before. Contrariwise in this study it has been possible to view the opposite where the resistance (unfortunately sometimes the diagnosis) has been lacking and we see at the autopsy table the whole story unfolded of how a primary urinary obstruction has been the impelling force that started the downhill trend that ended in catastrophe. Moreover, it was easy, by going back to the clinical histories of these autopsy cases, to find in many instances complaints that had been considered trivial or unimportant or symptoms that were not followed out to their ultimate conclusion. The continual stimulation to seek further has been the interest aroused by these mistaken diagnoses,

and the interpretation of symptoms as revealed by the anatomic findings and the light thrown by so vast a material into the practically unlimited variation that obstructive growth can assume.

And now to the material at hand: I have divided it into four groups that I might demonstrate more clearly the varying pathology: (1) The usual generalized prostatic hypertrophies. (2) The isolated median hypertrophies. (3) The obstructing median bar cases. (4) The malignant growths.

Under the first group of generalized hypertrophies the interest is immediately aroused by the variety of types that this may assume. The earliest evidence of lateral lobe enlargement is a beginning protrusion from one or both sides into the urethral lumen. This is often very decided before the lateral lobes themselves appear enlarged, and apparently may be well marked before encapsulation by the pressure of hypertrophy is established. This means that enucleation in such cases would entail more difficulty and not allow of as clean a cavity after the adenectomy as in a further advanced case. This lateral protrusion is easily visible cystoscopically and the necessity for operation in such cases should be judged more upon the amount of residual urine than on the fact alone that hypertrophy is present. There are other cases in which a relatively equal degree of early hypertrophy exists but in which it has its origin deeper in the lateral lobes and causes less intraurethral growth, more extraurethral pressure and earlier encapsulation.

From these early manifestations the grades of hypertrophic growth extend upward to almost an indefinite size. The usual growth remains fairly symmetrical with equal hypertrophy in either lateral lobe, though it is nowise extraordinary to find one lateral lobe forming a definite intravesical projection with but slight tendency toward enlargement of similar character in the opposite lobe.

In the enormous hypertrophies one sees varying degrees of dilatation of the internal sphincter, and upon this depends the extent and character of the intravesical herniation. There are,

FIG. 1.—Marked lateral lobe hypertrophy without any median lobe formation, showing a strong undilated internal sphincter and no distortion of the vesical neck. This is an ideal type for perineal prostatectomy, as suprapubic enucleation would undoubtedly damage the internal sphincter muscle.

in fact, two types. When the sphincter and trigonal muscle remain strong the hypertrophy raises the entire floor of the bladder without distortion of the viscus or its orifice and may attain enormous size without apparently affecting the bladder's symmetry. In such a case the posterior urethra is greatly lengthened and the growth seems much more strongly encapsulated and keeps the contour of an inverted truncated cone. Obstruction in these cases is due to the lifting of the entire vesical orifice plus the compression on the walls of the urethra by the enlarged lateral lobes.

When, as is more frequently the case, the sphincter is dilated and the hypertrophy herniates through it into the bladder cavity it obstructs and distorts the vesical orifice, creates a deep trigonal and post-trigonal pouch, becomes more rounded in shape and less definitely encapsulated, though more readily enucleated. The mechanical obstruction to urination here is one of hindered sphincteric function, dam-like distortion of the vesical orifice and the creation of a dependent bas-fond with its subsequent weakened bladder wall.

There have been a number, 37 (18.6 per cent) in all, of plain lateral lobe hypertrophies unassociated with the development of true median lobe enlargement, though let it be constantly borne in mind that in these cases the posterior prostatic commissure usually shares in the hypertrophic process forming a subcervical thickening of definite obstructive character.

Trilobular hypertrophy is of about equal frequency, there being recorded 34 (16.5 per cent) such specimens where the median and both lateral lobes show a definite enlargement. In this series of autopsies numerous excellent examples of such growths have been observed, but I will omit a further description as they represent but a combined effect of the forementioned type with the more interesting solitary median enlargements that I wish to give a special exposition of next.

Tandler and Zuckerkandl, Albarran and Motz, Wade, and especially Lowsley, have not only conclusively shown the frequency of median lobe hypertrophy but have demonstrated that

Fig. 2.—Trilobular hypertrophy with marked dilatation of the internal sphincter and distortion of the vesical neck and bladder base. The type of hypertrophy in which suprapubic enucleation would cause the least damage and make an easier operative approach.

the origin of this type of obstruction arises from that group of glands lying under the mucous membrane just distal to the vesical lip and called by Albarran the subcervical group. This median lobe hypertrophy has been so frequent an observation that I

FIG. 3.—A beautiful specimen of median lobe hypertrophy of the characteristic ball-valve type, with little or no hypertrophy in the lateral lobes.

am almost ready to agree with Tandler and Zuckerkandl that these tubules are never free of hypertrophy when the prostate

FIG. 4.—Adeno-carcinoma of the prostate with the characteristic dense prostatic mass, greatly narrowed urethral lumen, and in this case, showing subtrigonal proliferation of the neoplastic tissue.

enlarges, though feeling that in some instances the microscope would be necessary to confirm the judgment. I have seen 60 cases of solitary median lobe hypertrophy in this series of 881 autopsies, and in 34 other instances a median hypertrophy has been associated with lateral lobe enlargement (true trilobular hypertrophy), making a total of 94 such median lobe cases. I will show you solitary median lobes no larger than a dried pea, yet so obstructive that massive trabeculation of the bladder musculature has developed, while in other instances ureteral dilatation or hydronephrosis was present. I have found it in men from thirty-six to eighty-five years of age and have specimens where it has attained the size of the distal phalanx of one's thumb without lateral lobe involvement. I have cut sections in the midline to show its superficial submucous position and have dissected or enucleated it in others to prove its separate encapsulation and absolute freedom from lateral lobe attachment, and am convinced, beyond peradventure, that it is the most frequent, the most obstructive and oftentimes the solitary form of hypertrophy macroscopically, and that is clinically present.

This type of true median lobe is an hypertrophy in the subcervical glands of Albarran, and is not at all to be confused with an hypertrophy in the deeper gland tissue in the posterior prostatic commissure.

There should be a distinct differentiation made between these two types of median obstruction. Anatomically different and oftentimes clinically different they are distinctly different at the operating table, and upon an appreciation of this fact with the different handling of the two types the perfection and permanence of the operative result will depend. We have all seen the patent urinary fistula after either the suprapubic or the perineal prostatectomy, and we are prone to explain it by supposing tabs of redundant mucous membrane acting as valves. Possibly at times true, but candidly I believe that in the vast majority of cases easily enucleated lateral lobes have been removed while deeper and more truly obstructive hypertrophic prostatic tissue has been allowed to remain. It would surprise you to see

how deeply under the trigonal apex these growths can extend. And where else could they be more perfectly placed to hamper the action of the sphincter and detrusor muscle?

This leads directly to the subject of median bars, on which I wish to dwell but briefly and to recall to you anatomical points of operative importance to which I have elsewhere drawn attention. (1) The so-called median bar is purely a clinical term, used to designate an obstruction to the bladder that cannot be accounted for by lateral or middle lobe hypertrophy. (2) Such obstruction may be due to either of two distinctly different pathologic changes. (3) The choice of operation should depend upon a knowledge of the type of obstruction existent. These two types of pathologic changes are, first, a true fibrosis, and in this distinct pathologic difference from an hypertrophy it would perhaps be better to restrict the term median bar to it alone, except that the second pathologic change, a localized hypertrophy, gives a clinical picture identical with the first. With a nice appreciation of the difference between these two pathologic processes it is not beyond one's power to differentiate cystoscopically between the fibrotic and the hypertrophic bar formations, and with this distinction and its recognition to so vary one's operative procedure as to suit the problem at hand.

And by what different operative procedures, you may ask, are these cases to be handled? I feel the true fibrotic bar should be destroyed; the elevated vesical lip, the sclerosed sphincter, the narrowed orifice and the tortuous urethra should be rectified. This may be accomplished in one of four ways: Fulguration, punch operation, open dissection or by cautery destruction at open operation. The second type, due to hypertrophy of gland tissue, calls for closer study and nicer operative choice. When the hypertrophy is in the subcervical glands alone, is discreet, partially pedunculated, superficial and not too large, the punch operation should remove all; but when this hypertrophy is in the posterior prostatic commissure, in what Albarran terms the prespermatic glands, is deeply seated, rounded and broad-based,

then the open operation is essential, complete enucleation or cautery destruction being called for.

These are the facts that make me state that the median bar is, firstly, but a clinical term, with, secondly, a varying pathologic process causing its formation, and, thirdly, with a diversity of operative procedures individually applicable only when the underlying changes are appreciated.

The frequency with which cancer has been present in this series is not a true indication of its occurrence in operative cases, for the material has not been systematically sectioned for microscopic study. Its occurrence is low, only 5.8 per cent, *i. e.*, twelve cases in the grossly pathologic specimens, and they show but few changes that are not already well understood. The encroachment on the urethra, so generally appreciated on attempted instrumentation, is easily demonstrated in the dense, firm, adherent, inelastic lateral lobes, with, as a rule, a total absence of increased urethral lumen so characteristic of the benign hypertrophies. One outstanding feature found in three specimens is a malignant infiltration of the bladder wall as a result of a primary carcinoma of the prostate. It has been generally thought and taught that prostatic cancer remains for a long period restricted to the limits of the gland's capsule and that ultimately death comes from distant metastasis. This has been the case in the majority of specimens, and several times the autopsy protocol has been corrected to read primary carcinoma of the prostate with secondary metastasis to other organs at first thought the primary seat. But in the three specimens above referred to the malignant growth has spread both superficially along the urethra to the trigone and in one apparently without mucous membrane involvement directly into the bladder musculature. Evidences of great bladder obstruction are generally present with marked trabeculation of the vesical wall, and where the growth has involved the mucous membrane a peculiar mosaic mottling of the bladder floor, due to the infiltration of nodular malignant proliferation, has been its most outstanding diagnostic

characteristic. As regards the metastasis of prostatic carcinoma, it may be of interest to note that the autopsy protocols record such in 10 of the 12 cases: The pelvic and retroperitoneal glands were affected in 6; the pancreas, liver, lung, spleen, rectal wall and the parietal and visceral peritoneum in 2; while the ribs, vertebra and iliac bone in but 1 case only. One case of prostatic sarcoma has been encountered.

In closing let me add that my effort in showing these specimens is to bring to your attention the varying obstructive growths that produce the one clinical picture so generally spoken of as prostatism and the necessity of a careful preliminary study, including cystoscopy, in order to apply to each individual case the proper surgical procedure that will ensure a satisfactory and a permanent cure.

It is not essentially true, but nevertheless oftentimes obvious enough to be worthy of mention, that a great many surgeons look upon hypertrophy of the prostate as a sort of a classical entity to be found routinely of a fairly uniform type of growth, and its removal to be accomplished by finding a line of cleavage and enucleating all that can be obtained by blind finger dissection. My own experience is so at variance with this concept that I wish in ending to focus your attention on this one fact, that though hypertrophy itself can produce a vast variety of obstructive growths, there are also two other conditions causing a similar clinical picture which have to be differentiated in each and every case, as their proper surgical treatment is not the same as that of a benign hypertrophy.

I hope in presenting these specimens to you this evening that I will bring to your close attention the realization of some of these varying forms of obstruction, that your surgery may be guided into an effort to relieve such as suffer from urinary retention wisely, surgically and completely.

A CLINICAL STUDY OF BRONCHIAL ASTHMA AND ALLIED ALLERGIC DISORDERS, WITH A REPORT OF 200 CASES[1]

By SIMON S. LEOPOLD, M.D.

Hypersensitiveness was first studied by the production of anaphylaxis (experimentally) in animals.

In 1910, Meltzer observing the analogy between these phenomena in guinea-pigs and certain disorders in man, concluded that bronchial asthma was the result of anaphylaxis.

It is now believed that true asthma and its allied disorders are usually an expression of hypersensitiveness to certain substances which in the normal person are incapable of producing disease.

This study comprised a report of 200 cases of hypersensitiveness, of which 138 were diagnosed bronchial asthma, 15 asthma and hayfever combined, 26 hayfever alone, 18 vasomotor rhinitis and 3 angioneurotic edema.

In the group of 138 cases of uncomplicated asthma 27 per cent reacted to the animal epidermal proteins alone, 6 per cent to the foods alone and 9 per cent to both animals and foods. An occasional case reacted to orris root, wheat flour and various other substances.

Where the sole cause of the asthma was a particular animal protein, horse dander was the commonest offender. Cat hair and dog hair were less common offenders.

Feathers were frequently implicated but usually reacted along with various other members of the animal group.

[1] Read January 4, 1922.

The application of these findings is of importance. Asthma due to horse, cat and dog, where each respectively is the only or predominating reaction, seems to be a definite clinical entity. Of these the horse cases are the most clearly defined. Those most sensitive suffer not only when in immediate contact with horses but also from the amount of horse dander present in their environment.

In those sensitive to either cat or dog direct exposure produces asthma, but the removal of the offending animal in this group more often gives relief than in those sensitive to horse dander.

The explanation is either that the degree of sensitiveness to cat and dog protein is less or that there is less of it in the usual surroundings.

These cases are analogous to typical hayfever in which the severity of symptoms depends on the degree of proximity to the specific pollen.

When other animal substances react the reactions are generally multiple and there is usually no one reaction predominant. It is only occasionally that the removal of these substances from the immediate environment is of much benefit.

A group of these cases which showed no improvement by the removal of the offending substances were at various times during the past year referred to two different hospitals, one situated in the congested section of the city and the other in the suburbs. While in the hospital the patients were promptly and completely relieved. Upon returning to their former environment they again developed asthma with its usual severity. Several of these cases were readmitted to the hospitals and were again completely relieved.

Another patient in this group suffered an attack whenever he entered his bedroom. Protein extracts made from all the available sources in the room gave negative cutaneous reactions. His asthma persisted until the room with its furnishings was vacated. Since that time he has had no recurrence.

It therefore appears that many of these cases showing animal reactions, with the exception of those definitely due to exposure to horse, cat and dog, should be interpreted as indicating sensitivity

to substances absorbed by inhalation from their environment. This group of cases, relatively large and extremely important, has been recently designated dust asthma. It is probable that this group also includes those cases in which asthmatic attacks are induced by tobacco smoke, factory smoke, crowded rooms, theaters and various other environmental substances. Presumably these specific irritants are not all protein in nature.

The results of treatment also seem to bear out this grouping. Those cases sensitive to horse, cat and dog are always benefited by avoiding the offending animal and are often relieved for a variable length of time by immunizing doses of solution of the causative protein. Those showing multiple reactions to other animal proteins, with no one reaction predominant, are usually only imperfectly relieved by the removal of the offending substance, but are often completely relieved in another environment.

In the further investigation of these substances, chemically and immunologically, lies the hope of their isolation and their therapeutic application.

Food reactions occurred in 14 per cent of all the asthma cases studied, but in only 6 per cent was it considered to be the causative factor. The most striking therapeutic results were in 4 cases sensitive to egg. In one of these egg hypersensitiveness was also present in the mother, the mother's brother and the maternal grandmother.

Food hypersensitiveness is usually manifested in early life. It has a tendency to correct itself as the child grows up. Asthma first appearing in adult life is infrequently of food origin.

As most of our cases occurred in adults relatively few food cases were studied.

Fifty-six per cent of all the cases in the asthma group were negative to all the proteins with which they were tested. Bacterial proteins were used diagnostically for cutaneous tests in a large number of cases, but with such uniformly negative results that their use was discontinued. No positive reactions were obtained, neither in those cases acquiring asthma late in life nor in those

cases which seemed to follow directly upon an acute respiratory infection nor those with demonstrable focal infection.

We thought that our failure to obtain reactions with the bacterials might be due to differences in the strains of similar organisms. We therefore made bacterial proteins from the predominant organism isolated from the patient's sputum. These also yielded negative results.

Forty-four patients were treated with autogenous vaccines. The method employed in obtaining and washing these specimens was reported by Mr. Burns, working under Dr. Lewis, at a recent meeting of the Pathological Society. By this method, deduced by Mr. Burns, often but a single type of organism remained in the washed sputum. Two-thirds of the cases in which these autogenous vaccines were used were materially benefited. There is no question that vaccines are beneficial in asthma. Often a patient is promptly and completely relieved by their use. The immunity, however, which is established is of relatively short duration, and it is usually necessary for us to repeat vaccine treatment at intervals of three to six months.

The evidence in favor of the view that vaccine treatment is specific may be summed up by these facts.

In four cases of this group where two organisms were isolated from the washed sputum a vaccine made from one produced no benefit. A vaccine made from the second gave almost immediate relief. On several occasions an attack of asthma developed within thirty minutes after vaccine administration and was presumably induced by the vaccine. It is almost uniformly true that a vaccine which is beneficial even in its initial dosage produces local reaction. Rackemann makes vaccines from all the organisms recovered and uses only those which, by preliminary injection, produce the greatest local reaction.

The evidence opposed to the specificity of vaccine treatment can also be summarized. Peptones have been enthusiastically advocated by Auld in the treatment of bronchial asthma.

He explains its mode of action by stating that in artificial

anaphylaxis a shock is produced which in no way differs from primary peptone shock. He believes that peptone is truly antigenic and acts by a process of nonspecific immunization.

We observed that it is usual for chronic asthmatics to state that they are asthma-free during most intercurrent infections, especially those of the respiratory system.

Finally, although the administration of bacterial vaccines may precipitate an asthmatic attack, no reaction truly allergic in nature such as urticaria and angioneurotic edema have been observed from overdosage. Despite the favorable clinical results from the use of vaccines, their mode of action is very imperfectly understood. Most observers are content to say that they combat the secondary infection. According to Cook it is a matter of great question as to whether the bacterial proteins or toxins are allergic in the strict sense of the word.

In this study there are 15 cases of hayfever and asthma combined. They all exhibited positive reactions to the pollens; 2 cases also reacted to horse dander and 1 to dog hair.

The continuation of the asthma beyond the hayfever season may be due either to a freshly acquired sensitivity as indicated by these three cases or may result from secondary bacterial infection.

Twenty-six cases of uncomplicated hayfever were studied. All but one case showed characteristic pollen reactions. June grass was the chief offender in the spring type, short ragweed almost invariably in the fall type. Preseasonal treatment with pollens following Walker's method were very successful in the spring variety. Most of the fall cases were benefited. None were completely relieved.

There were 3 cases of angioneurotic edema; 1 proved to be sensitive to egg, 1 to banana and 1 showed no reaction. The first 2 had apparently been cured by dietary control.

Eighteen cases of vasomotor rhinitis were studied. Two-thirds of these reacted, 2 to animals, 2 to foods, 3 to orris root and 5 showed multiple sensitivity. The orris root cases were promptly relieved by avoiding orris root containing substances.

One patient whose occupation necessitated exposure to orris powder is at the present time receiving desensitizing treatment.

This group of cases of vasomotor rhinitis seems to indicate that the majority of these patients are very amenable to treatment. In most of them the offending substance is absorbed by inhalation, but in some the foods, especially the vegetables and fruits, are the apparent cause. Many patients exhibit multiple sensitivity.

A group of cases of bronchial asthma and allied allergic disorders have been presented. Most of these cases fall into rather well-defined clinical groups despite the difficulties incident to interpretation of skin tests, their variability and their occasional appearance when they are not etiological factors. On the classification of these disorders depends their therapeutic management. A considerable number of cases, most of them showing multiple animal sensitivity, with no one reaction predominant, are considered to fall into that ill-defined group designated as dust asthma. In this group are included those patients whose asthmatic attacks are induced by crowds, smoke and other environmental conditions. Surely not all of these substances are protein in nature. The bites of insects have occasionally produced allergic manifestations. The investigation of human epidermal proteins may help to discover some of these environmental substances not yet isolated and analyzed.

Although some success has attended our therapeutics with specific and nonspecific immunizing substances, their *modus operandi* is still highly theoretical and their results temporary.

A better understanding of those processes which underlie specific treatment in the hypersensitive and further knowledge concerning many other environmental substances now little known will lead to greater progress in the field of applied immunology.

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DISCUSSION

Dr. Paul A. Lewis: The speaker referred to the fact that the bacteriological examinations on a number of the cases which are the basis for his presentation were made in the laboratory of the Phipps Institute by Mr. Burns. Mr. Burns has perfected a method for the bacteriological examination of sputum, and in so far as the cultivation of bacteria found in this material is concerned, the work is to be relied upon. I do wish, however, to make it quite plain that the cultivation of bacteria from sputum even under the most carefully controlled conditions, the contamination with bacteria from the nose and throat being eliminated so far as possible, it is still inconclusive as evidence that these bacteria bear any causative relationship to the symptoms in question. It is highly desirable that a much more complete presentation of the histories of individual cases be given and carefully correlated with the bacteriological findings, and, where possible, with the results of vaccine treatment in order that some conclusion may be reached in this very difficult field. With reference to these cases of bronchial asthma, which might now be designated as due to abnormal reaction to protein, it is evident that when the nature of this intoxicating protein can be determined, and when by change of environment or food the patient can be removed from contact with it, much can be accomplished. I consider, however, that the question of the desensitization treatment of these protein asthmatics is still on trial. Scientifically speaking, we know that the animal in the sensitive state can be desensitized temporarily by appropriate treatment, and it is logical to assume that this can at least be partially accomplished in the case of the human being. There is much evidence that such desensitization of human beings gives relief, at least in many cases. What we know of the subject from the point of view of abstract science, however, would lead us to expect that the desensitization must be temporary always and that it will be followed by a return to the sensitive state sooner or later. The symptomatic relief, therefore, would be expected to be temporary. Here, again, the presentation of the careful records of an individual case must be the basis of our judgment. The summary of opinions, even though these be based on a wide clinical experience, is far from satisfying from my point of view.

Dr. J. Alexander Clarke, Jr.: Dr. Leopold is to be congratulated on his results with vaccines. We never try vaccines until everything else has failed. People rather get the idea they are not going to get relief and the results are not satisfactory. A word about dust: I am afraid you

might get the impression from Dr. Leopold's talk that the dust diagnosis is a scrap-basket diagnosis. We never diagnose any case as a dust case until we can produce a good live, local reaction. Nothing is diagnosed as a dust case simply because we cannot place it anywhere else. They must all give positive reactions, and constitutional reactions have been obtained with these dust preparations. Now we have no idea whatever as to what it is in this extract which gives the reaction, but it is there and we can produce constitutional reactions with it. We have tried everything, as Dr. Leopold has said. We have gone over all parts of the furniture and everything else in the bedroom and cannot find the origin of the offending substance. Making over the bedroom, repainting, papering, getting rid of everything, like old carpets and mattresses, may give temporary relief, but the obnoxious dust is apt to recur. He may be free from asthma for three or four months and then have it recur. I might say that the desensitization results with dust are quite satisfactory. They are not as satisfactory as those obtained with the epithelium of a dog or a cat, but in the general run of cases they are well worth while.

Dr. Richard A. Kern: I have been very much interested in Dr. Leopold's paper. In the reports published by a number of previous observers, especially in Walker's earlier work, we were led to believe that food substances played a comparatively important role in bronchial asthma. Dr. Leopold's findings, those recently reported by Dr. Clark and others, agree with my own in that the inhalation of substances is of far greater etiological significance. It is true that many of these are specific, such as the pollens or the animal epidermal substances. Frequently, however, dusts of various kinds play an important part. Skin tests may serve to discover some of these, but at other times it may be necessary to completely change the patient's environment. By piecemeal removal of the various dusts to which the patient is exposed one may at times find the offending substance. Occasionally an epidermal substance is thus found to be the cause, although skin tests with the protein in question are negative. Perhaps in these cases we are dealing with localized sensitization involving the respiratory tract, whereas the skin gives no allergic reaction. In this connection a case recently reported is of interest: In a patient with eczema of the exposed parts due to guinea-pig hair, positive skin tests could be gotten only in the exposed parts, elsewhere they were negative.

Dr. Simon S. Leopold (closing): Regarding the questions of Dr. Lewis and Dr. Clarke as to the therapeutic use of vaccines, I wish to state that I have tried not to overestimate their value. Many cases presented them-

selves at my clinic incapacitated for work, and many of the cases incorporated in this report returned to their occupations. They were not entirely asthma-free but were greatly improved. I have knowledge of several cases, not clinic cases, in which the patients were house-confined and bedridden, and these patients, after vaccine treatment, were able to pursue something which approximated a normal existence. If these were the neurasthenics of which Dr. Lewis speaks, they had every reason to be so. The problem of vaccine treatment cannot be settled until we know the mechanism whereby immunity is produced in those hypersensitive. I have attended Dr. Clarke's clinic and have witnessed the reactions obtained when testing intradermally with dust and other substances. What I meant to indicate was that the dust collected from a particular room by that patient may react to a much greater degree on that patient than a stock dust or one collected from another patient's immediate environment. It seems to me that much advance in this phase of the subject cannot be made until something of the chemical nature of these dusts is known.

ON CERTAIN CHANGES IN OUR CONCEPTION OF ANTIBODIES AND ANTIBODY REACTIONS

The Mary Scott Newbold Lecture

LECTURE VII[1]

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I

In the study of biological problems there are at all times fundamental thresholds of comprehension beyond which available experimental procedures do not permit us to penetrate and at which progress is temporarily arrested until new methods, more exact means of chemical or physical measurement or some hitherto unrecognized correlation have made the next step possible. At such a point, before indulging in speculation, it is always well to take a new inventory of all the facts available for reasoning, to tear them out of the classifications into which conventional acceptances have placed them and to reëxamine the premises from which new theory may take its departure.

In immunology the accumulation of facts has been so rapid that it has not always been easy to distinguish between superficial similarity and fundamental relationship. We need only point to the field of anaphylaxis for which these difficulties have been well indicated by the confusion there has been in deciding whether or not such phenomena as true protein anaphylaxis, toxin hyper-

[1] Read February 1, 1922.

susceptibility, tuberculin and typhoidin reactions, hayfever and asthma, serum sickness, drug idiosyncrasy or the toxicity of normal sera for other species were processes dependent upon the same fundamental principles or whether they must be looked upon as due to entirely uncorrelated biological circumstances.[2]

Purely as classifications these matters are questions of convenience; but classifications should indicate fundamental relationship in order that they may be used for ordered thought. It has seemed useful, therefore, in connection with our work on bacterial hypersensitiveness to reëxamine in this way the basic theories which have guided immunological thought in the course of the last twenty-five years.

It is reasonable to assume, as Ehrlich did, that *the tissue cells of higher animals are normally prepared only for the metabolic processes concerned in the nutritional and excretory functions essential to the maintenance of life,* the liberation of energy and the performance of any special secretory functions peculiar to their respective provinces of activity in the general body economy. Compared with the cells of the simpler forms of life, the normal functions of the mammalian tissue cells are considerably less wide in range. A protozoan cell, for instance, may take up boiled starch granules or bacteria and deal with them by complex processes, killing the bacteria in an acid vacuole, digesting them subsequently in an alkaline medium and extruding waste products. In only a few cells of the body, such as the phagocyting ones, either free or fixed, does such an atavistic ability to deal with substances unprepared by digestion survive.

We are not equipped to enter upon matters of cell nutrition in an authoritative manner, and, indeed, this is not necessary in the present connection. The essential consideration is that *in the bodies of the higher animals the substances which reach the cells for nutritional purposes through the blood or lymph stream, or perhaps through the intercellular fluids beyond the lymphatics, come into*

[2] See the excellent summaries of Doerr, in Kolle and Wassermann, Handb. der pathog. Mikr., 2d ed., 1913, ii, 947. Coca, in Tice: Practice of Medicine, New York, 1920, i, 107. Wells: Physiol. Rev., 1921, i, 44.

actual cellular contact only after elaborate preparation by preliminary digestive processes. Thus, proteins probably reach the ultimate cells which they nourish only in the form of amino-acids; the fats are in the form of glycerol, fatty acids and perhaps soaps, and the carbohydrates in that of simple sugars. The cell is thus normally attuned only to dealing with substances in the chemical and physical conditions into which such preliminary digestion has put them. *It is only such substances, apparently, which can come into repeated or continuous contact with cells without in some way altering the quality or degree of the cellular reactions aroused by them.* It seems to be a fairly general biological principle that most materials which are not in this chemical and physical class of predigested nutritive matter give rise sooner or later to a specifically altered state of reaction capacity on the part of the cells. Thus, even when dealing with substances as relatively low in molecular structure as alcohol, some of the narcotics, quinine, morphine and other alkaloids, etc., the mere facts of habituation and occasional idiosyncracy indicate that such altered conditions have been produced. And, indeed, such drug tolerance or habituation cannot always be explained entirely by increased powers of excretion or destruction of the tolerated drug. For, although such increased eliminating properties are involved in the process, still it has been shown, at least in the cases of alcohol and morphine tolerance, that equal concentrations of the drugs in the blood stream of normal and of tolerant individuals may cause a deeper state of intoxication in the abstainers than in the habituated. (Rubsamen, Van Dongen, cited from Wells.) Thus, it is necessary to assume, as Wells puts it, "a certain refractoriness or cellular immunity in addition." So, too, as we proceed upward toward the more complex substances with which the bacteriologist and immunologist more particularly deal (the bacterial "proteose" with which we have been working, the toxins and the proteins proper), contact of cells with these substances, incident to processes of infection or artificial parenteral administration, invariably induces an altered reaction capacity which is recognized either as some form of hypersusceptibility or of tolerance.

When we consider the varied chemical and physical constitution of the many substances which may thus come into contact with the body cells, from the drugs at the bottom of the list to unchanged proteins, it need not astonish us if the manifestations accompanying the development of such susceptibilities or tolerances are subject to a wide range of variations. *Common to all of them, whether it is the fluctuating tolerance to morphine or the quasi-permanent acquired immunity to plague, cholera or typhoid, is a fact that the tissue cell is basically changed in its reaction to the particular material concerned* with a degree of *specificity which seems to be more striking as chemical complexity of the foreign substance increases.* Important differences, however, exist in the laws governing the acquisition of the altered cell reaction capacity and in the manifestations by which they may be recognized. These differences have been analyzed by a number of recent reviewers (see particularly Coca and Wells), and it is not necessary for our purposes to enter into the detailed controversial points involved.

Basic to such discussions has been the classification of all these phenomena into *two main subdivisions: Those in which definite antigen-antibody reactions* are involved and in which passive transfer to normal animals is, therefore, feasible, *and those in which no antibodies seem to be concerned and passive transfer is consequently unsuccessful.* The problem has received particularly careful analysis in relation to reactions of hypersusceptibility. Here the various manifestations of increased susceptibility to proteins in which antibody formation is unquestionably and easily demonstrable constitute a sharply defined class, the so-called condition of anaphylaxis, about the basic mechanism of which there is very little essential difference of opinion among workers. Apart from this well-defined group, however, stand many other phenomena of hypersusceptibility, in which the antibody mechanism so clearly concerned in typical protein anaphylaxis is either uncertain or can be definitely excluded. Thus, under the heading of hypersusceptibilities in which an antibody mechanism may be excluded with a considerable degree of certainty, we would place most of the drug

idiosyncrasies.[3] Reasonable doubt and legitimate difference of opinion may also exist in regard to the participation of antibodies in the ordinary sense in hayfever and in some food idiosyncrasies, and the direct participation of circulating antibodies is unlikely in the tuberculin, typhoidin, mallein, etc., reactions.

The ability of the cell thus to express its response in the production of specific antibodies which, in the course of the reaction, may become free in the blood stream is the chief point which separates the mechanism of one type of reactions (the protein ones) from all the others. But even in reactions in which antibodies occur (immunity to plague, typhoid, etc., or anaphylaxis in the very early or very late stages after active sensitization) the changed reactions can exist on a purely cellular basis without the intervention of detached antibodies. Indeed, the cellular properties by virtue of which the typhoid convalescent remains resistant for years after recovery are just as little understood today as is the mechanism of the tolerance to morphine. *Regarded in this light, the formation of free antibodies, practically important as it is, may still be looked upon as an incident rather than as a fundamental difference,* dependent upon the manner in which the chemical or physical properties of the inciting substance permits it to react with the cell. This point will be further discussed below.

Ehrlich, whose lines of reasoning we have followed in the main, with others of his time conceived the cell as a *giant molecule,* a homogeneous chemical system with an enormous molecular weight,

[3] We say "most of the drug idiosyncrasies," since there are a considerable number of instances in which investigators have claimed the possibility of passive transmission of hypersusceptibility to a number of medicinal agents. Coca throws these out, in the summary mentioned above, largely on account of the fact that the majority of investigators have failed either actively or passively to induce hypersensitiveness of this kind in animals. For his reasoning we must refer the reader to his article. There are, however, reports such as those of Swift (Journal American Medical Association, 1912, lviiii, 1236) with salvarsan, Klausner (Munchen. med. Wchnschr., 1910, 1918) with iodoform, Bruck (Berl. klin. Wchnschr., 1910, p. 517) with iodin, Hanneman (Munchen. med. Wchnschr., 1918, lxv, 665) with quinin, and others in which passive transfer is definitely claimed. Whenever this has been claimed, however, it is assumed that the mechanism is dependent upon an entrance of the responsible chemical group of the medicinal agent into the protein molecule and a consequent antigenic modification of the protein in the sense of Pick, Landsteiner and others. This would place such forms of drug hypersusceptibility into the class of protein anaphylaxis and, therefore, would not influence this argument.

provided with a large number of "side chains"; these "side chains" were conceived as normally adapted for union with the various types of foodstuff that might be brought to the cell in the course of nutrition, but also capable of reacting with other substances reaching the cell under unusual conditions if they happened to have chemical affinities which fitted with one or another of the normally provided "side chains." It is not necessary for us to follow this well-known, purely chemical reasoning in his explanation of antibody formation. Since his time the *conception of the cell entity has changed considerably.* The material is perhaps most thoroughly brought together in Bayliss's book, and a clear discussion of some of the problems involved may be found in recent articles by Alsberg on chemical structure and physiological action. The cell can no longer be regarded as a large molecule of living matter, the life of which is maintained by a constant interchange of chemical unions and dissociations, but must be conceived, as Alsberg puts it, "*as a heterogeneous series of phases separated from each other by semipermeable surface layers,*"[4] resulting from the concentration at the surfaces, particularly, of lipoidal substances. But the semipermeable membranes which separate the internal subdivisions of the cell and delimit it from its environment probably do not consist of lipoids alone, but are composed of complex "colloidal intermixtures of lipoids and proteins."[5] It is clear that the reaction of an extraneous substance with a cell must depend not only upon its chemical but also upon its physical properties, according to which it may enter the cell and react with the substances in its interior or may come into direct contact only with the outer-surface phases of the protoplasm. It is also quite probable that the permeability of the cell membrane may change under various functional conditions, and that in the problems of hypersusceptibility a part of the process may consist of an increased ability of the injurious substances to get into the cell. In fact, though we have not yet made the matter one of special study, we have noticed on a number of occasions that the isolated uterus of

[4] See also work of Clowes.
[5] Bayliss.

a sensitized guinea-pig was more irritable to nonspecific extraneous substances than were the uteri of normal guinea-pigs. This matter, however, needs more definite investigation. *At any rate, the question of cell permeability to extraneous substances is quite as important in guiding our reasoning about immunological problems as is the matter of chemical structure.*

As will be seen below, our own reasoning along these lines was largely guided by studies on the tuberculin sensitiveness, but a paper by Landsteiner[6] has recently come to our notice in which he approached a similar point of view by studies on precipitin reactions to altered proteins. By a process of experimentation, absolutely different from our own, he too suggests that the significance of proteins for immunity reactions may not depend entirely upon their chemical structure, but that their physical condition, especially as regards molecular size, may considerably influence such reactions.

Alsberg points out three general ways in which substances may affect cells: They may attack the surfaces of the cells either by precipitating, coagulating or dissolving parts of the constituents of the surface, or by coming into chemical or purely physical union with only these surface layers. Again, they may enter the cell and cause chemical and physical alterations within the protoplasm. Other substances, again, may react with the cell in an indirect way only by altering the concentrations within the cell.

Thus, in reconstructing our ideas of the changes which may take place in cells under conditions of immunization or sensitization, we must depart from the purely chemical conception of Ehrlich to the extent of including in our considerations the physical properties of the foreign substances concerned, especially as regards their ability to enter the cells or to react with the surfaces only.

When we look upon the conditions governing altered cell reactions from this point of view, we are struck by the fact that *antibody formation, a property by virtue of which the inciting substance is classified as an "antigen," is exclusively an attribute of materials*

[6] Biochem. Zeitschr., 1919, xciii, 106.

which are practically nondiffusible, proteins or substances that have not been chemically separable from proteins hitherto. Considering this in connection with the fact that in test-tube reactions between such antigens and their antibodies the phenomena which are observed follow closely the analogy of colloidal reactions and are intimately dependent upon physical conditions of the environment, the thought suggests itself strongly that *nondiffusibility, the property of reacting only with cell surfaces, and antibody formation are in some way connected.* Although this thought is at the present time one that cannot be approached by direct experimentation, it is still of sufficient importance for the shaping of experimental thinking to be expressed. Thus, tolerance and hypersusceptibilities to drugs and other substances that pass easily through semipermeable membranes would be conceived as based on intracellular processes in which, perhaps, substances functionally analogous to antibodies may play a part, but in which the ease with which the foreign substance can enter the cells renders unnecessary a mechanism for the production of circulating antibodies. In the case of proteins, on the other hand, where diffusion does not normally occur, the process takes place on the surface of the cell, and here the reaction products, as we know by observation, are eventually discharged into the circulation, and represent those factors in the circulating blood by virtue of which the tolerance or the hypersusceptibility can be transferred to normal animals.

Our own thoughts were turned in this direction largely by the experimental work we carried out upon the tuberculin and similar reactions. It is well known to all of you that there are at least two types of definite skin reactions: One of these is the immediate, urticaria-like wheal which appears within a few minutes after intradermal injection into individuals sensitive to foreign proteins, such as horse serum. Every physician who has tested pneumonia patients before the injection of serum has seen these reactions, prompt in appearance, fading rapidly, usually within an hour, leaving hardly any cell injury behind. The other variety is the "tuberculin" type of reaction, in which no visible change appears for four, six or eight hours, but in which, at the end of twelve,

twenty-four, or perhaps even forty-eight hours, there appears a deeply inflamed area often with a slight central necrosis and perhaps a little hemorrhage. These lesions, by their appearance and by their slow healing, plainly indicate profound cell injury. In studying such reactions in guinea-pigs we found that the former type, the immediate reactions, could be elicited in the animals by the same methods by which general anaphylaxis is produced. They appeared in sensitized animals during the stage of generalized anaphylaxis, disappeared on desensitization and could be produced both by the active and passive sensitizing processes. In other words, they are coincident with other manifestations of anaphylaxis, are probably an expression of this condition and depend upon what we speak of as "sessile antibodies."

This, however, is not true of the slow tuberculous type of reaction.

In working with tuberculous guinea-pigs and with guinea-pigs injected with the extracts of killed tubercle bacilli, and using the delicate Dale method with the isolated uterus as an index of anaphylaxis, we found, as Baldwin and others had found, that tuberculin reactions of the skin and true anaphylaxis to tuberculo-proteins do not run parallel. Tuberculous guinea-pigs will show a typical skin reaction to tuberculin within eight or nine days after infection, a time at which no signs of anaphylaxis to the tuberculo-protein are manifest. Such infected animals, however, will not develop true anaphylaxis until about three to six weeks after the administration of the living bacilli. Conversely, guinea-pigs treated in the ordinary manner with dead tubercle bacillus extracts never developed the typical tuberculin reaction, but usually became typically anaphylactic to the extracts in about three weeks after a series of injections.

Thus, hypersensitiveness to tubercle bacilli may be resolved into two entirely separate mechanisms: one, tuberculin hypersensitiveness, which appears only after infection with living bacilli within eight to ten days after inoculation, and which apparently cannot be passively transferred; the other, typical anaphylaxis to the tuberculo-protein, which never appears in infected animals until several weeks after the tuberculin reaction has been established,

and which may be induced in normal guinea-pigs by appropriate treatment with dead tubercle bacillus products, running its entire course without ever being accompanied by the typical tuberculin hypersusceptibility.

In further analyzing the difference between these two phenomena it appeared logical to inquire whether or not two different constituents of tubercle bacillus cultures might not be responsible for the two separate phenomena. And, indeed, it was found that extracts of tubercle bacilli from which nucleo-proteins had been precipitated with acid in the cold and coagulable proteins had been removed by boiling with acid, contained a residue which still gave typical and powerful skin reactions in infected animals. Thus, the tuberculin skin reaction, slow in appearing and deeply injuring the cells of the injected area, is obviously caused by bacillus constituents molecularly smaller in all probability than the tuberculo-proteins, which, for want of a better name, we speak of as the "proteose residue." And it is not a very remote thought to assume that the intracellular nature of the skin reactions might in part be due to the greater diffusibility of these substances. We attempted to show this in experiments in which we studied the passage of the anaphylaxis-eliciting proteins and this proteose residue through fish-bladder bags, and, indeed, obtained a few results from which it appeared that the tuberculin substance might pass slowly through certain membranes through which the proteins did not diffuse. However, it is hardly possible at the present time to transfer test-tube diffusion results to the explanation of reactions with the living cell, except in so far as these experiments support rather than contradict the reasoning outlined above.

It seemed to us, then, that the tubercle bacillus contained these two antigenic elements: one, the tuberculo-proteins, which because of their larger molecular size and indiffusibility were capable of inducing antibody formation and consequently true anaphylaxis; the other, the less complex proteose-like substance, with which it was either very difficult or entirely impossible to produce antibodies, and in which the reactions of hypersusceptibility became

more definitely intracellular. Their partial diffusibility inhibited antibody formation and consequent failure of passive transference, and at the same time explained the more obviously intracellular injury caused by their injection into sensitized animals.

Incidentally, it is interesting to examine for a moment the question as to why such tuberculin hypersusceptibility could be produced only in infected animals. We reasoned that, perhaps, sensitization to these less complex substances might follow laws of quantity and time different from those governing the development of protein anaphylaxis, and carried out the following experiments: Tubercle bacilli were allowed to grow on glycerin broth flasks until the growth had attained about the size of a silver dollar. At this time about one-fifth of this growth was transferred to another flask containing 100 cc of broth, and the remainder of the growth, about four-fifths, was washed in salt solution, killed and infused in a flask of similar volume. From day to day tuberculin reactions were carried out on tuberculous animals with the contents of these flasks, and it was found that the flask containing the small quantity of living tubercle bacilli soon contained a much larger quantity of the tuberculin active material than did the flask in which the large amount of dead bacilli was infused. The presumption was, therefore, that in the tuberculous animal these more diffusible products are constantly being passed out into the animal body in a steady stream, in cumulative amounts far exceeding those which can be extracted from corresponding quantities of dead bacilli. We are now engaged in attempting to simulate this manner of absorption with dead bacillus products, with results which will be published later.

If these results with tuberculosis can be extended to other infections, a matter which is now under experimental investigation in our laboratory, it would appear that in every infection—in addition to the anaphylaxis to the bacterial proteins which develops as a late result—another kind of sensitization is taking place: A sensitization to nonprotein materials constantly passing out from the focus, not toxic in themselves but soon rendered capable of injuring as the animal becomes hypersusceptible.

In the course of these investigations we attempted, of course, to separate completely the anaphylaxis producing tuberculo-protein and the proteose residue; but to our surprise found that, although the proteose residue seemed to react as powerfully with the skin as the original whole extract, we could never, even by repeated precipitation, remove skin-reactive functions from the original bulk of the nucleo-protein removed from the extract by acid in the cold. At first we thought that this was due to the fact that proteose impurities were always carried down with the first precipitate, but later failures to purify convinced us that this was probably not the case. The possible alternative is that this so-called nucleo-protein (which constituted the bulk of the bacterial extract) might prove to be the mother substance of the proteoses which are constantly diffusing out from foci and cultures into the surrounding medium. This is being investigated, without conclusive results up to the present time except for one very interesting observation: Dr. Petroff, who is following out this line of investigation in our laboratory, has found that the serum of a sheep highly immunized to tubercle bacilli and their extracts will give precipitin reactions with the proteose residue; and Mrs. Parker, who is engaged in studying the same phenomena for us with staphylococci, has made analogous observations with these bacteria. It would seem possible, therefore, that in the bacterial materials with which we are dealing, we are confronted with a substance which does not easily produce antibodies when injected into an animal, but which is, nevertheless, capable of reacting with such antibodies. This is particularly interesting to us because it is a view which is also suggested by Landsteiner by observations of an entirely different nature. Incidental to his work with azoproteins, he says: "In accordance with these observations it is not unlikely that there are substances which can react with antibodies without themselves possessing the property of inducing them. Perhaps the difficulty of producing antibodies with tuberculin may be an example belonging to this category."

II

The burden of the preceding section, then, is that the reaction of the body cells to the administration of foreign substances is governed not only by purely chemical considerations, but, to some extent at least, by the physical condition of the substances injected. It is pointed out that all the substances known today which incite the appearance of so-called antibodies in the circulation are of large molecular structure and nondiffusible, reacting primarily only with the surfaces of the cells. It would seem perfectly reasonable on this basis that altered reactions on the part of the cells should, therefore, take a different form and be subjected to entirely different laws, respectively, when the injected substances are nondiffusible proteins or highly diffusible medicinal agents, like quinin, the alkaloids, etc., and between these two extremes there must be a spectral range of many materials up to the primary proteoses in which there is a gradually increasing difficulty of diffusion, a condition which would profoundly influence their reactions with the cells. It is by thinking of these matters in this way, and by connecting the fact of antibody production with the nondiffusibility of the antigens, that perhaps a more general and coördinated theory of allergic reactions can be obtained.

About this general conception nothing more can be said until further experimental data have been collected. Meanwhile, there are many problems associated with the antibodies formed against the true antigenic substances in which our conceptions are undergoing considerable alteration at the present time. As we have seen, it is only with substances either frankly protein in nature, chemically inseparable from proteins or closely related to proteins, that we are capable of arousing the specific reaction products known as antibodies. Among such substances we can distinguish two main classes: In the one class are physiologically or chemically active materials such as the toxic culture products of certain bacteria, the true exotoxins, vegetable poisons like ricin and krotin, animal poisons such as snake-venoms, spider-poisons, etc., and perhaps certain enzymes. All of these materials are capable of

producing either powerful injury or, as in the case of enzymes, of causing effects in potency out of all proportion to the quantity applied. All of these substances may be regarded as definitely injurious to the materials on which they act.[7]

The specific antibodies formed against these substances are definitely neutralizing and the neutralization follows relatively quantitative laws. These are the so-called antitoxins, and it is interesting to note that even in the toxin-antitoxin union there are important features, such as the Danysz effect, which would suggest analogy with colloidal reactions. We must, however, refrain from a discussion of the analysis of the reactions of the exotoxins and similar antigens with their antibodies, since, for our present purposes, we wish only to call attention to the fact that these substances differ from antigens in general in that they are physiologically active and give rise to the production of a form of antibody which possesses a specific and quantitatively neutralizing effect upon their respective activities. In the interest of clearness of thinking, therefore, we suggested some years ago that this class of antigen be separated from all the rest by speaking of them as "antitoxinogens."

In contrast to these active antigens are all other antibody-producing substances, a class in which we may include all known proteins and perhaps some of the higher protein derivatives. It may even be that some of these substances are not proteins in themselves, but, so far, their separation from the proteins has been unsuccessful. These substances in themselves cause no noticeable

[7] It is interesting to note in this connection that the effects of the intradermal injection of, let us say, diphtheria toxin in a normal subject are pathologically very similar, both in time and appearance, to the effects of the injection of such primarily harmless substances as tuberculin into the sensitized subject. This would imply that the ability to enter into harmful combination with the normal cell possessed by diphtheria toxin were produced for tuberculin by the active sensitization; in other words, the cell in the course of infection acquires the power to unit with tuberculin in a way in which the normal cell can unite with the toxin. Similarly, ricin will act upon the normal red blood cell in a manner analogous to the action of alexin upon a sensitized cell. The injury apparently is referable not so much to the different states of the injuring material as to the ability of the substrate to establish chemical or physical relations with it. This is a little irrelevant in the present connection, but nevertheless contributes something to the general understanding which we are trying to submit.

injury to the normal animal, but after they have been in contact with the animal body once or several times they induce antibody formation, by virtue of which the cells may be rendered accessible and vulnerable. In the preceding section we have sufficiently outlined our belief that antigen-antibody reactions within this class may vary in a number of important respects, governed perhaps by the molecular size of the antigen, which will determine how deeply into the cell the process can be carried. This we have referred to in the description of our work with tuberculin. However this may be, it is clear that the antibodies produced by the proteins differ in certain fundamental ways from the true antitoxins. At any rate, the original antigen being harmless in itself, we cannot think of the antibody reaction in terms of neutralization, but we do know that these antibodies by specifically uniting with the antigen may produce a number of different reactions with them, which can be determined both in the test-tube and in the animal body, and which can be subjected to measurements with a considerable degree of quantitative accuracy. It is concerning the nature of these antibodies that our general point of view is changing and in a manner which to us appeals as a material simplification of the entire subject.

When animals are repeatedly injected with an antigenic substance of this class, their sera will become capable of reacting with the inciting substance in a great many different ways. When, for instance, as the animal is treated with typhoid bacilli until its serum is high in specific antibody contents, this serum will agglutinate suspensions of typhoid bacilli; it will precipitate typhoid extracts; it will sensitize the bacilli to phagocytosis (opsonic action); it will render them capable of fixing complement or alexin and thereby, perhaps, expose them to a more intensely destructive alexin action (bactericidal or bacteriolytic effect); and injected into normal animals such serum will render them hypersusceptible to the bacterial protein. Similarly, if an animal is treated with horse serum, the antibodies appearing in its circulating blood give rise to complement-fixation reactions. As these observations were made, each effect was attributed to a new antibody, and we are

faced with the generally accepted view that with one and the same antigen we may produce in an animal separate reaction products, specifically spoken of as agglutinins, precipitins, bacteriolysins or hemolysins, complement-fixing sensitizers, opsonins and anaphylactic antibodies. In a recent paper on this same problem I have quoted Kraus as summarizing these views in the following way: "Just as the bacterial cell body contains a variety of antigens, so we may assume that animal protein is made up of a large number of different antigenic elements. If an animal is treated with such substances and possesses corresponding receptors, there results the formation of a variety of qualitatively different antibodies." Ehrlich's well-known theories as to the structure of these several antibodies are too familiar to be reviewed, but quite early in immunological studies the idea that at least some of these different experimentally determinable effects might be due to one and the same antibody crept into the work of a few investigators. As early as 1908 Bail and Hoke, on the basis of the Pfeiffer reaction with cholera spirilla, expressed the opinion that the agglutinating and bacteriolytic effects of normal beef serum on these organisms might be due to one and the same antibody. Paltauf, even before this, suggested the identity of agglutinins and precipitins, a view accepted by many different German investigators and expressed by von Eisler in 1909. A little later Dean, analyzing the relationship between alexin fixation and precipitation, concluded that the proportions of antigen-antibody which favor rapid precipitation do not favor complete alexin fixation. He concluded that the two reactions followed a parallel course, but thought that they represented two phases of the same reaction. In the same year, in studies carried out along similar lines, we, ourselves, came to the conclusion that the antibodies which were involved in the fixation of alexin were essentially the same as those that brought about precipitation. The studies of Friedberger, and especially those of Doerr and Russ, have shown that the power of a serum to confer passive anaphylaxis is quantitatively proportionate to its precipitin contents, thus establishing a just reason for the possible identification of precipitating and

anaphylactic antibodies. Thus, gradually, there has accumulated in the literature much evidence to strengthen the supposition that the various antibody effects might after all be due to one and the same constituent of the serum.

To be sure, there are also many experimental observations that would caution one to proceed slowly in such an important conclusion. However, most of the arguments which are used to fortify the assumption of the existence of many different antibodies are based on quantitative discrepancies between the contents of different antibodies and one and the same serum. In appraising such experimental data, however, we must remember that agglutination, precipitation, opsonization, complement fixation, etc., are all secondary phenomena consequent upon the union of antigen and antibody, and are dependent upon a great many environmental factors which may materially influence quantitative results. For a detailed discussion of the reasons for and against the unitarian view of antibodies we must refer to a recent paper on the "Essential Identity of the Antibodies," published by us in the *Journal of Immunology*. In this place let us merely make perfectly clear exactly what we mean by the essential identity of antibodies and by the unitarian theory. We do not mean by this that a complex cell like a bacterium, for instance, or a chemically complicated substance like horse serum, may give rise to the production of one variety of antibody only. Such materials may contain a mixture of proteins and other antigenic elements, each one of which may give rise to its own specific antibody; but we do mean that when we are working with a single antigen in a pure state, one variety of antibody only would be produced. This would be present in the form of a serum constituent, specifically capable of uniting with the antigen. As a result of such a union the antigen is changed, perhaps somewhat in its chemical behavior, but chiefly in its physical condition.

Thus, if the antigen is in a very finely divided condition, as in bacterial extracts or in horse serum or egg-white solutions, union with the antibody will change it in such a way that electrolytes will precipitate the united complex. If, on the other hand, the

antigen is in the form of a relatively large mass, as in the case of red blood cells or bacteria, if electrolytes are present and other environmental conditions are properly adjusted, agglutination occurs. It is hardly to be expected that quantitative parallelism between precipitation and agglutination of the same antigen should occur, since in the latter case the antigen is of larger mass, of smaller surface exposure, and would naturally follow entirely different quantitative relations in its flocculations.

When the antigen and antibody meet in the presence of alexin, the changed condition of the antigen now permits union with the alexin, from which follow complement fixation, and perhaps bactericidal and bacteriolytic effects.

When there are leukocytes present, phagocytosis is possible, and when the antibody is injected into a normal animal and attaches to the tissue cells the reaction capacity of these cells for the antigen is increased and anaphylaxis results.

Thus, by a unitarian view of antibodies we mean that we need not assume that a great many differently constituted antibodies result from the injection of antigen into the animal body, but that we have a considerable amount of reasonable evidence to permit us to assume that only one antibody is formed; that this antibody is capable of specific union with its antigen, and that the various so-called antibody effects which we can notice in the test-tube and in the animal body are merely different expressions of this union, differing because of differences in the environmental and in the experimental details by which we make the observations. As Dean has well expressed it in his Dobell lecture: "The various serum reactions are various methods of observing and measuring one single reaction." The basic cause for all the reactions is a change in the physical state of the antigen, which is more complete —and therefore visible—in such reactions as precipitation and agglutination, but which in its less extreme form may be indirectly observed by complement fixation, by opsonization and by anaphylactic reactions.

IV

One of the great difficulties opposed to our obtaining a more clear understanding of antigen-antibody reactions has been this complex chemical nature of the substances involved. Until recently, attempts to isolate either the antigenic substance or the antibody in anything like a chemically pure form have been unsuccessful. It has been known for a considerable period that in such reactions as the precipitin reaction by far the larger part of the precipitate formed was derived from the proteins in the immune serum. This fact is apparent very simply from the formation of a bulky precipitate in reactions in which the dilution of the antigenic protein is as high as 1 : 1000 or higher. Indeed, it can be assumed quite definitely that when such reactions take place the antibody carries into the union a considerable amount of inactive serum globulin, which is probably passive as far as the reaction is concerned. It is the participation of such inactive serum globulins which we believe is responsible for precipitoid and agglutinoid phenomena, in that these substances, after heating, act as protective colloids and prevent flocculation. This, however, is mentioned merely by the way. The important point is that recent advances have made it possible to work with antibodies in a relative state of purity. In 1903 Landsteiner with Jagic showed that the specific agglutination reaction was reversible; in other words, if bacteria were sensitized with specific agglutinating sera, and were then exposed after washing with salt solution at 55° C. for variable periods, the antibodies would dissociate from the union to some extent and could be studied in relatively protein-free solutions. Observations of similar import were made by Morgenroth, in 1903; by Bail and Tsuda, in 1909, and since then by a number of other observers. Gay and Chickering, in 1915, succeeded in splitting off a relatively protein-free antibody from specific precipitates. Kosaki, in 1918, split hemolytic immune bodies from sensitized sheep corpuscles by washing them with salt-free isotonic saccharose solutions. Huntoon has recently studied these conditions very thoroughly in connection with

sensitized pneumococci. By various methods he has been able to dissociate antibodies from the agglutinated organisms and obtain them in a form which gave none of the usual chemical protein reactions. While this, of course, does not prove that they are protein-free, since none of the chemical rests are sufficiently delicate to permit us to make such a claim, it certainly suggests that they may not be proteins and opens a field of investigation from which, perhaps, eventually the intimate chemical nature of the reactions may be elucidated. This, with our own determination that certain types of antigens, precipitable by antibodies, may also be obtained in a manner which would suggest the absence of proteins, brings us, we think, considerably closer to eventual accurate investigations into the nature of these profoundly mysterious and important phenomena.

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RADIUM THERAPY, WITH SPECIAL REFERENCE TO DISEASE OF THE FEMALE PELVIS[1]

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AND

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The price we pay for civilization and progress is manifest in the diseases which affect civilized peoples and from which mankind in a primitive state is apparently immune. This applies with striking force to cancer, which so evidently keeps pace with modern civilization. It is a well-known fact that probably as many as 500,000 or more of the population of this country are today suffering from this insidious and loathsome disease in one or another form. It is only natural that the efforts of a host of investigators should be and are directed almost exclusively toward discovering the fundamental cause of the disease, with the hope of ultimately arriving at a permanent method of curing it, if not at its eventual eradication. The only very definite and indisputable facts which all the study, research and investigation have established are that there is a so-called cancer age of greatest susceptibility, that cancer may result from some form of chronic irritation and that in its earliest stage it is local and amenable to treatment and almost certain cure.

The deductions to be drawn from these simple facts, beyond which our definite knowledge does not yet extend, are clear. The first is to be on the alert; that is, to watch for cancer at the cancer age; second, whenever possible to remove the causes of

[1] Read March 1, 1922.

irritation and finally radical treatment of the early lesion. There is little if any divergence of opinion that surgery is the best possible therapy for early carcinoma accessible to the knife. Even the most enthusiastic radiologist, I believe, will concede this point. Unfortunately neither the surgeon nor the radiologist gets enough early cases to satisfy his earnest desire to cure them all. It is along these lines that all our efforts must be directed in the immediate present and future, for it is here that preventive surgery approaches its greatest field of usefulness and no doubt will play the dominant role in the reduction of cancer morbidity.

Human nature, in spite of evolution and progress, has in certain respects undergone very little change. Men have at all times eagerly sought the golden fleece, fashioned utopias and devised panaceas for ills, mental, moral and physical, with which mankind continues to be afflicted. In medicine the list of panaceas is a long one, but we have only to mention such modern pseudo-scientific practices as Christian Science healing, chiropractics and allied methods as examples. In the legitimate and truly scientific field, so anxious is the profession for real light in the pursuit of its course toward eliminating physical suffering that there is danger of smothering each new discovery in an over-enthusiastic embrace. This applies with particular emphasis to radium in the treatment of cancer. On the strength of the statements of the enthusiast and the exaggerated reports of the commercializer there has arisen an overestimation of the possibilities of this wonderful substance put into our hands by the marvellous genius of the two Curies. Much of this exaggerated evaluation of what radium can accomplish is due to misrepresentations in the public press, which, whether wilful or unwilful, have the same effect. It seems necessary at this time to correct these false impressions, not in a spirit of belittling the value of this new agent, but for the purpose of preventing future disillusionment and disappointment. Knox, in his presidential address to the Section of Radiology and Electrotherapeutics of the British Medical Association,[1] also deplores such ill-advised suggestions

[1] British Med. Jour., 1921, ii, 267.

in the lay and in the medical press as that all cases of malignant disease as soon as a diagnosis is made should go to the radiologist. He adds: "The time has not yet come when radiology can be regarded as the first choice in the treatment of the majority of cases of malignant disease. We believe that surgery still offers the best chances of cure in nearly all cases of cancer, and that until much more convincing proof of the efficiency of roentgen rays or other forms of radiation is forthcoming, it would be extremely dangerous to encourage patients to submit to roentgen-ray treatment for these very serious conditions before the advantages that surgery possesses have been fully discussed."

No right-thinking person for a moment denies the palliative effect of radium in the treatment of cancer, nor does anyone doubt its curative value in certain types of superficial external cancer. A careful study, however, of the literature shows that really scientific observers agree that radium is not the panacea which the lay mind has been led to think it to be. Furthermore, there is an almost general consensus of opinion that radium therapy is still in its experimental stage, coupled with the desire that its future development will be such as not to frustrate the ardent hopes of the many thousands who are placing their confidence in it.

Among internal tumors cancer of the uterus and the cervix stands high, if not the highest, in the list for frequency and malignancy. It is for these that a cure is most eagerly sought. Radium therapy in this type of case, besides its physical limitations, is also limited by anatomical considerations, that is, the primary seat of the growth and its extension. Experiences, opinions and statistics are at variance as to the curative powers of radium for uterine carcinoma. But it is from large numbers of cases, followed for not only a five-year period but for many years, that results may fairly be judged. Baisch[1] has recently reported results in 300 cases of carcinoma of the uterus and the cervix treated with radium and mesothorium and followed for a five-year period. Of these, 108 patients survived but only 74 (25

[1] Strahlentherapie, 1920, orig., 36.

per cent) were free from recurrence. Among 42 cases in which the primary seat of the growth was in the cervix only 7 (16.6 per cent) were living and free from recurrence for the same period. Among these there were 12 in which the disease involved the entire cervix but had not yet extended beyond, and of these a five-year cure was obtained in 25 per cent. This is the type that also gives good results from surgery. On the whole, Baisch, once an enthusiastic radiologist, frankly states that, "The high hopes aroused by radium have not yet been realized." Good results are obtained only in very early cases, while in later and advanced ones the end-results are not any more satisfactory than those obtained by radical operation. On the other hand, recurrences after radium treatment seem to grow and metastasize much more rapidly than those after operation and do not yield to radiation, while the operative cases with recurrence are said to be not quite so intractable. In the inoperable cases there is little question but that radium treatment is palliative and makes life more bearable for the sufferer. In the cured cases (Baisch) the results generally showed obliteration of the canal and the os, while the vagina was closed and ended in a funnel-shape, although a few presented conditions more nearly approaching the normal.

Personally, my cases treated with radium have not been systematically followed long enough to establish results. Those under observation, however, give the impression that radium gives temporary relief but does not cure cancer of the cervix. The reaction after a first and second application is generally satisfactory. Subjectively the patients appear improved; locally hemorrhage is controlled and the ulcerated surface becomes smooth. But within a year or less signs of metastasis or recurrence appear and the outlook begins to darken. I can scarcely believe that I stand alone in this experience. Some authors have made the observation that recurrence after radium treatment usually appears in about nine months and that no recurrence after a year is as good as a cure. No one, of course, can agree with this statement. The disappearance of the tumor, however, does not necessarily mean a cure if the disease has extended to

the lymphatics or has metastasized to distant foci, which radium cannot attack any more than the most radical operation can destroy.

The biological effect of radium is not as yet definitely established. Knox[1] observes that: "So far we have not been able to gauge with accuracy the biological response to the radiations on the part of the tissues acted upon. . . . Indeed, the correct appreciation of the action of radiation upon living tissues may eventually revolutionize all our preconceived ideas regarding metabolic processes and lead to very drastic changes in therapeutic methods."

According to the law of Bergonie and Tribondeau, immature cells and cells in an active state of division are more sensitive, that is, less resistant to radiation than mature cells whose morphology and function are fixed. A number of theories have been advanced in explanation of this law in regard to cancer cells, the favorite one being the embryonal theory. The cancer cell is considered an embryonic cell and is therefore easily attacked by radiant rays. But this leaves out of consideration the fate of other embryonic cells in the body which lack the same means of protection against the rays as the cancer cell. This apparently is one of the still obscure questions in radiation therapy. Of course, these other cells are protected by screens and filters, but is protection always possible?

It is generally admitted that a "massive lethal dose" that will destroy all cancer cells is necessary for a complete cure. This means that no modification of the cancer cell except its total destruction and death will cure the patient. Thus there is a very definite limitation to the curative effect of radiation no matter how efficacious it may be, and no doubt is, in retarding or even temporarily inhibiting growth of the cancer cell. So long as any living cancer cells remain the danger of a flare-up into activity is ever present.

The question of the penetration of the rays and the size of the dose are also still matters of opinion and discussion. "The

[1] Edinburgh Med. Jour., 1921, xxvi, 273–337.

selective action of radiation and the gamma rays of radium is an established fact. But the complete and definite sterilization of a neoplasm is still a matter of technical details, varying with the type and localization of the tumor—details which are far from being regulated."[1] I believe a conservative estimate is that 50 mg. of the gamma rays, the penetrating rays, destroy cancer cells within a distance of 1 cm. after an application of twelve hours; a tumor within a distance of 2 cm. requiring a twenty-four-hour exposure with the same quantity of radium, etc. The effects of twenty-four hours' exposure with 100 mg. would be about the same, but 200 or 300 mg. would be safe only if applied to different parts of the tumor in order to get the 100 mg. action at each part.[2] Instead of the direct application of radium, radium emanations are being used by Janeway, of New York, Kelly of Baltimore, and many others. These two authors claim 25 per cent of five-year cures in all cases of cancer of the uterus "where there was no general metastasis and especially if the metastasis had not spread to the broad ligaments. This then would decidedly mean that radium may cure cancer of the uterus in selected cases and in the hands of experts. So I believe does operation in selected cases in the hands of the expert surgeon.

The most frequent argument against radical operation is its high mortality when performed by any but the experienced surgeon. Radium in the hands of the inexpert is probably much more dangerous because of the immense amount of irreparable damage it may cause, which only a benign Providence can relieve by early death. It is this type of cases, treated or rather maltreated by radium, that I am so often asked to help by operation when it is past all human help.

The radical operation for operable cancer of the uterus and the cervix now claims a mortality of about 5 per cent (reported by Graves in his own cases and those of Pemberton and of Cobb),[3] with a five-year curability of 27.6 to 34.2 per cent. In Graves's

[1] Regaud: Congrès Internationale de Chirurgie, Paris, 1920, p. 283.
[2] Schmitz: Surg., Gynec. and Obst., 1916, xxiii, 191.
[3] Surg., Gynec. and Obst., 1921, xxxii, 504.

119 cases only 2 (1.7 per cent) developed postoperative fistulæ. It is in view of such figures that operation in operable cases should still be considered a choice, if not the chosen method, of treatment for cancer of the uterus and the uterine cervix. The use of radium as a preoperative measure is advised by some authorities and discountenanced by others. Schmitz,[1] for example, advises strongly against it for the very plausible reason that inasmuch as the radiation required is such that the periphery of the bony pelvis is attacked with the same intensity as the cervix, and the peripheral cells are apt to be stimulated to increased proliferation. This intense radiation produces a toxemia which makes operation unwise for at least three to six weeks. On the other hand, postponed operation presents a danger on account of the unavoidable necrosis of tissue in the cervical canal and the intense connective-tissue formation in the parametrium, which makes hemostasis difficult.

Postoperative radiation, however, is more generally approved as a possible means of destroying cancer cells that may have escaped the knife at operation. The combined treatment is by many considered more successful than one or the other alone, although Clark and Keene[2] warn against radiation soon after operation or on a fresh operative field. In spite of the fact that a few years ago he reported 33 per cent of five-year cures in his operated cases and now reports a 24 per cent five- to seven-year cure in his cases of cancer of the cervix treated with radium, Clark in his enthusiasm is predicting the time to be near arriving when the question of operable cancer of the cervix will no longer be considered, since all cases will be subjected to radium treatment.

I am inclined to believe that the best results will be obtained by a combination of radiation and surgery; that is, provided the patient is otherwise in good condition for operation after the first or second reaction from radium. I have asked Dr. Reimann to present some of the details of the pathology of uteri thus removed.

[1] Jour. Am. Med. Assn., 1921, lxxvii, 608.
[2] Ibid., lxxvi, 693.

In benign disease of the uterus and adnexa radium therapy occupies a prominent place. I need scarcely stress the point, however, that the presence of inflammatory disease of the uterine appendages constitutes a contraindication to the use of radium in otherwise favorable conditions for its application.

In so-called myopathic hemorrhage, a term glibly used but as yet never accurately defined, hemorrhage is definitely controlled and probably permanently relieved. But in young women there is danger of producing an artificial menopause. The dosage must be carefully considered, since the reaction varies in different individuals. In some of these cases where examination either manual or with the speculum reveals no definite cause for the bleeding, it appears to me a rational measure to open up the uterus and ascertain if possible the cause, and whether or not the case is suitable for radium treatment. This procedure would hold the same relation to the best interest of the patient as does a frozen section in a case of tumor in which the question of malignancy is in doubt and in which the result of the section indicates a conservation or a radical operation, as the case may be.

The treatment of uterine fibroids with applications of radium is gaining rapidly in favor. But here also the method has its limitations. In young women, below the age of forty, surgery is still generally regarded as the better method. The best results with radium are no doubt obtained in the intramural fibroid uncomplicated by adhesions. But the large subserous tumor and multiple fibroids cannot be made to disappear completely by any other means than by surgery, by which at the same time the structure in which the growth is located can be removed. Radium may cause a diminution of the size of the tumor, but that, of course, does not mean a cure. Personally, I cannot subscribe to the use of radium for uterine fibroids except where there are definite contraindications to operation. The mortality for operation in fibroids in my hands is so small that I cannot conscientiously advise radium except for the reason above indicated. The artificial menopause which it may produce in young women is, to say the least, serious, while the results are not too inviting in the

woman at or beyond the menopause. No one can ever be sure that there is no latent chronic infection in the Fallopian tubes. I speak from experience when making this statement, because I have in mind several instances that have come to operation for just such a condition in which radium applications had been made by the so-called expert. In two instances at least, both occurring in the same year, I have known death to result from pelvic suppuration following the application of radium for small uterine fibroids. Fistulæ, necrosis and fibrosis are some of the sequelæ of the application of radium, but I have never experienced any of these morbid conditions after operation for fibroid. No one that we know of can, without opening the abdomen, say whether or not myomectomy, either through the external or the internal approach, could not have been done in the cases treated by radium.

Whatever may be the future of radium therapy the fact remains that it is today not the panacea for cancer the advent of which is so eagerly being awaited, for in numerous cases in which it is most needed it has not as yet fulfilled expectations.

RADIUM THERAPY IN CONNECTION WITH DR. DEAVER'S PAPER

By STANLEY P. REIMANN, M.D.

During the last few years we have had the opportunity of examining a number of specimens removed at varying intervals after exposure to radium or roentgen rays. Among these were nine uteri, and six of these have come in the last six to eight months. Among the others were a number of carcinomata of the breast which had been exposed to the roentgen ray, several tumors from other regions of the body and a leg the site of a fibrous tissue tumor in the popliteal space. There are a number of impressions which have been gained from these specimens. In the first place many curious pictures were found, especially in those which had been roentgen-rayed and in which there was no surface reaction; in

fact, when a tumor, obviously a carcinoma, showed signs of more degeneration or more inflammation than usual the question was asked concerning its exposure to radiation. Very frequently this was answered positively. One can therefore say that a new pathological anatomy has arisen—the pathological anatomy due to changes produced by radiation. These changes can be grouped and put in general terms, and by reference to our specimens which had been removed at varying intervals after radiation we are able to reconstruct a more or less continuous picture which mirrors the course of events. These changes have been described a number of times, but they may be rehearsed and the photographs shown here will bring to mind some of the more important features. The first manifestation occurs in seven to fourteen days and is inflammation with its accompaniments: namely, active congestion and exudation, the latter of which consists of edema, a small amount of fibrin, polymorphonuclear leukocytes and a few lymphocytes. The tumor cells swell at the end of about two weeks, their nuclei become dense, then pyknotic, and the chromatin is dispersed by karyorrhexis. The cytoplasm disappears. Many smaller vessels show an endarteritis. Immediately following these phenomena there is a reaction on the part of the connective tissue. Fibroblasts appear and infiltrate between the nests of degenerating carcinoma cells. As time goes on these fibroblasts become fully-grown connective-tissue cells, and among them can still be seen fragments of the original tumor. These changes have their limit, of course, and on the edge of the limit may be seen carcinoma cells to all appearances, at least anatomically, alive when the section was made. There is no question, therefore, but that radium destroys tissue and there is little question that radium destroys tumor cells more readily than it destroys normal tissue. Perhaps it might be better to put it in this way, that tumor cells are more susceptible to the influence of radiation than healthy tissue. Our series of cases is not sufficiently large to justify any conclusions on the question of the relative susceptibility of various tumors. Our sections show undoubtedly that tumor cells are more susceptible than

normal tissue. Ewing states that those tumors of a more cellular character, with their cells less differentiated, which show rapid growth, many mitoses and many fine capillaries, are the most susceptible. On the other hand, those tumors which contain less and more highly differentiated cells and which grow more slowly and with a smaller blood supply are relatively refractive. This is indeed very important and one might say almost that the crux of a large portion of the situation lies here. Even with the experience which we have, covering only a few years, there is no doubt that radium offers the best relief for inoperable cases even though it cannot effect a cure. In the cases in which operation seems to promise complete removal of the growth there seems little doubt that this should be the method of choice at the present time in the very largest majority of cases. It seems to a pathologist that the surgeon can remove as widely as a safe dose of radiation can ordinarily reach, and it seems also, to a pathologist, that a carcinoma removed is more positively out of the sphere of action than one which has been radiated; at least this would appear probable in the present state of our knowledge. Even a study of the literature shows confusion everywhere with multitudes of opinions based on insufficient evidence. There may also be found many sets of statistics which if analyzed prove little, or one might say nothing. This charge may be brought against both radiologist and surgeon, but particularly the former. The question of "safe dose" has been raised and it is here that the pathologist again should raise his voice. During the last year I have performed an autopsy on a woman who had had radium applied for a small myoma. She died in about two months after the surgeon by operative procedure had made a vain attempt to clear up a pelvic abscess. At the autopsy little was left of the uterus but a mass of necrotic tissue, and a considerable portion of the sigmoid had sloughed and allowed free communication with the abscess cavity and thence to the surface through the operative incision. But a short time ago another pelvic abscess was treated operatively and the uterus removed. This uterus had been radiumized about three or four weeks previous for a presumed myoma. A photograph of the specimen

is shown. Perforation had occurred just above the external os and the pathology of bleeding was probably the small polyp suspended from the fundus. Radium is therefore a two-edged sword, for to kill all carcinoma cells when they are beyond a certain distance and unfortunately this is a circumscribed distance, a dose dangerous in the extreme must be given. To give less will kill the carcinoma cells in the immediate neighborhood, but since very small doses stimulate, it is likely to accelerate the growth of those beyond its destructive range. Furthermore, if its destructive influence is less manifest on more differentiated cells it appears, *a priori*, that certain tumors should not be attacked at all. Fibro-leio-myomata are composed ordinarily of highly differentiated cells closely approaching the architecture of the normal uterine wall or of the normal fibrous tissue. It would seem that a destruction of these would be improbable without a very large dose, and in two uteri which I had the opportunity of examining the destructive effect was little manifested. The other idea, namely, that they shall be caused to shrink by diminishing their blood supply through the selective action of radiation in producing an endarteritis should be considered very carefully, for we all know of very large pedunculated fibroids which have as their nutrient vessel a surprisingly small artery passing through the pedicle. Just how much of the blood supply must be abolished in order to produce shrinking, hyalinization and other changes is a difficult question, but which nevertheless should be considered.

As a summary these ideas might be expressed tersely as follows:

1. Radium destroys cells within its sphere of influence.

2. Tumor cells are more susceptible than the cells of normal tissue.

3. Tumor cells vary in their susceptibility, this being in direct proportion to their degree of differentiation.

4. Radium is an extremely dangerous means of therapeusis and its dose is not as yet thoroughly understood by even competent radiologists.

5. Many opinions have been expressed, most of which lack sufficient evidence for conclusions; statistics have been published, very few of which will stand careful scrutiny.

DISCUSSION

Dr. Edward B. Krumbhaar: Unfortunately it does not take a very long acquaintance with radium to allow one to see some of the damage that can be done by this powerful agent. A few months ago I saw an autopsy on a case of carcinoma of the cervix very similar to that spoken of by Dr. Reimann. The case was radiated outside the limits of this city and later brought to the Philadelphia General Hospital. Not only had the carcinoma been removed by the radium, but also a large amount of neighboring healthy tissue, so that there was a large opening between the vagina and peritoneal cavity, and the patient died of pelvic peritonitis. This should teach the lesson that radium should not necessarily be used in such cases, but emphatically that we must know a great deal more about it, and that can only be reached by careful experimental and clinical study. There can be no discussion about the undesirability of radium being used by unskilful people; neither, on the other hand, should there be any discussion as to whether major surgery should be attempted by unskilful people, as is unfortunately sometimes the case. Of course, also, the point is not open to discussion that it is reprehensible for the public press to give the impression that radium is a panacea; but when radium has unquestionably been proved of value as a palliative and also as an apparent cure in certain forms and cases of malignant disease, it seems very unfortunate and equally reprehensible to have the impression produced by the public press that radium is of no value and has no future as a therapeutic agent in scientific medicine. Perhaps these remarks all seem like truisms, but I want to emphasize the need for the most careful and exhaustive study, unhampered by prejudice, not only along experimental but also along clinical lines of this very powerful agent.

Dr. George E. Pfahler: I assure you that I appreciate very much this very excellent discussion by both Dr. Deaver and Dr. Reimann. They have brought out most of the truth, I think, about the subject. There is no doubt that we have a very powerful agent in radium, and while it can do much good, it can also do much harm. It requires skill in its use and, as Dr. Deaver has well said, the technic in handling it has not been fully developed. It will require years until it is developed fully, but I think we must not lose sight of the fact that, considering the limited experience that we have had with radium, the small amount that most men have had to work with that really remarkable results have been obtained, and it is almost surprising that more harm has not been done considering the fact that radium is sold today to anybody, and sold without any ideas whether they have any experience or whether they are going

to try to get any experience. It seems that the only essential is the possession of radium. As a comparison I would say that most of us in this room can buy a set of surgical instruments such as Dr. Deaver possesses and uses in his wonderful surgery, yet we cannot produce his wonderful results in surgery. Surgery is a subject which has developed over literally hundreds of years, but especially during the last fifty years, and after we have fifty years back of us in radiology we will probably do much better work than today. I think these words of caution are in order, but I do not think we need to stop where we are and condemn an agent which has shown itself so powerful, as indicated by the results, thrown on the screen by Dr. Reimann. We must learn to control and handle it, and there is a curative force in the body which we must learn to handle. None of us are sure whether it is the natural resources stimulated by the radium or whether purely the destructive action of the radium produces the results. The results are probably mostly due to distributed action on the cells. We must find that out, and experiments are being done on that line. Some I am doing myself. When one associates with the action of the radium in the uterus the effect of deep x-ray therapy such as we are now able to give with our 200,000 volt machines, much better results are being obtained than have been obtained by surgery or any other means, because we are able to reach some of the metastases.

As to the treatment of fibromas of the uterus, I think most men have recommended surgery when surgery can be done. A few men have taken the stand that practically all cases of fibroid of the uterus can be treated by radium, among these Dr. Béclere, of Paris, has reported 500 cases with good results in 98 per cent. His records must receive serious consideration. However, Dr. Deaver has well said that during the child-bearing period if the uterus can be operated upon and a myomectomy done and the uterus conserved and the child-bearing function saved this certainly ought to be done. We still have quite a number of women who cannot be operated upon and some others who will not be operated upon. I remember one woman distinctly whom I refused to treat because I thought she ought to be operated on, and I requested that she see Dr. Deaver and have him operate. She saw no one and went on and bled to death. I think it is our duty to put clearly before every patient the truth as near as we can determine, and they should be the ones to decide just what shall be done.

Dr. Nicholson: It seems to me to be rather unfair to cloud this discussion by including a consideration of fibroid tumors. As Dr. Deaver has said, the mortality of operation in suitable cases in the latter type of case is so slight that there seems to be no reason to consider the use of radium. On the other hand, uterine carcinoma is a very different proposi-

tion. In this matter I have come to a very definite belief, which is that if one can diagnose cervical carcinoma by the introduction of the finger into the vagina it is a matter of very little importance what type of operation is performed, since the woman is certainly doomed. In this class of case I am perfectly certain that the use of the cautery followed by radium (the dose and application of the latter agent being controlled by an expert) is a much more valuable procedure for the prolongation of life than the most expertly performed operation of a radical nature. I do not believe that the extensive operation has really increased the total days of life in a series of these cases, since this radical operation has such a large mortality, even in the hands of acknowledged experts, that the operative deaths more than counterbalance the small number of successes. I am, of course, referring to the true Wertheim operation. There are a large number of so-called Wertheims which are really no more than an ordinary panhysterectomy. If the old statistics of Byrne are consulted it will be found that his results were as good as any which have been produced since. It is true that he did not have the complete microscopic study of many of his cases, but I am personally of the opinion that he knew the feel of an advanced carcinoma as well as we do, and that he made few mistakes. Of course, this statement does not apply to cases of fundal carcinoma. If a woman has to have carcinoma anywhere in her body the best place is the uterine fundus, since surgery can almost assure a complete cure, and therefore there is no excuse for radium applications.

I am entirely in accord with Dr. Pfahler in his warning against the use of radium by inexperienced persons. He says that any man can buy radium in the same manner as any other instrument. I would put it a little stronger by saying that any man can buy radium as readily as he can a Ford car, and that in many instances both will be used in about the same inexpert manner. I have had recently under my care a ward patient with a rectovaginal fistula the result of the use of radium in a well-known gynecological clinic for the purpose of the removal of a fibroid tumor. This is inexcusable. Radium dosage and application should be in the hands of the man trained in its use. As far as my experience has gone this does not mean the gynecologist.

Finally, I believe that the use of radium following the skilful use of the actual cautery, according to the plan followed by Dr. Pfahler and myself in my service in the Graduate School of Medicine of the University, is a very definite addition to our armamentarium in the handling of these unfortunate late cases of cervical carcinoma. Certainly it is very much to be deplored that anyone of experience should influence the laity adversely by destructive criticism of this plan at the present time, since there is no question that if radium fails to improve these advanced cases the aseptic scalpel had better bow its head in all meekness and humility.

PAY CLINICS[1]

By WALTER L. NILES, M.D.
NEW YORK.

The medical profession is faced with the necessity of readjusting its relations to the public; we are forced to relinquish our traditional individualistic status and conform with the growing social forces of today. Whatever our desires we are compelled to change, for the very good reason that we are servants of the public, and the public is not getting from our profession what it believes it should get. It is my opinion that the public is not getting all that we should or can give, and that, too, without any greater expenditure of time and energy. What is needed is a readjustment of the efforts now made to prevent and relieve the ills of mankind. In what way and by what means this will be accomplished is not yet clear, but an understanding of the malady is essential before the remedy can be applied.

The factors which have brought about this state of affairs are numerous, but the principal one is the great widening of the field of knowledge in those sciences which are fundamental to medicine. It is no reflection upon the profession to affirm that no individual possesses sufficient knowledge to assemble and properly assess the relative values of all the facts which may be necessary to establish a complete diagnosis in a complicated case. Occasional following of cases to the autopsy table will prove this and develop a healthy spirit of humility. Furthermore, the numerous tests and examinations essential for a thorough diag-

[1] Read March 1, 1922.

nosis require the services of highly trained physicians and the employment of costly apparatus and materials. And all of these things are expensive. The result is that only two classes of people, neither of which is very numerous, are able to command the best medical service—the very rich and the very poor: The latter because they are freely given the vast resources of our admirably equipped and ably manned hospitals; the former can afford to pay for a group of physicians assembled for their individual needs.

There remains a large class of people, industrious and ordinarily self-supporting, who when illness overtakes them are unable to meet the expenses of extensive investigations and diagnostic consultations. Just how large this class is cannot be determined from the medical standpoint alone but must be studied by relating the economic status to the amount of sickness and the cost of medical treatment. It makes a great difference whether a man with a certain income has no dependents or has a large family, and whether the illness developing in himself or his family is trivial and of short duration, or seriously complicated and chronic. Studies made along this line in New York City by Dr. Michael Davis, executive secretary of the Committee on Dispensary Development, led to the conclusion that about two million persons (one-third of the population) are unable to meet the expense of prolonged illness or of care of specialists.

It appears, therefore, that this large group of people is generally not receiving the best that medical science possesses, and one may conclude that it is from this class that the profession receives the strongest criticism and that it exercises great power in fostering legislation inimical to physicians.

I heartily agree with Dr. Frank Billings in his opinion "that a painstaking general practitioner is able to make a correct diagnosis in a large majority of all patients with the readily available small chemical and instrumental equipment and a thorough use of properly trained special senses." I am also sure that he is right when he says: "Today the public suffers because many general practitioners neglect to make the examination and record

of the patient's condition, and in consequence the treatment and management given are slipshod, haphazard and often ineffectual. It is natural, therefore, that a substantial number of the public should turn for relief to the public pay or free clinic, or to a group of private practitioners, or place themselves in the hands of faddists and practitioners of the cults. In fact, one of the chief reasons for the growth of the cults is the failure of the general practitioner to give the best that is in him in service to his patients. Just why this is so it is difficult to estimate. In part it is due, I think, to the belief of many practitioners that modern medicine requires in all cases the application of all the refinements of laboratory and instrumental assistance in making a diagnosis; the fact is those refinements in diagnosis are required only in a small percentage of patients."

It is evident that the relation between the public and the medical profession is more or less strained and that this strain is increasing. Prof. S. J. Holmes, in an address before the Pacific Division of the American Association for the Advancement of Science, said: "It will not be removed, I fancy, until some system is evolved whereby the rank and file of suffering humanity, who have no relish for becoming charity patients, can obtain the medical attention they require at prices that are not prohibitive. There is a growing sentiment, both in the medical profession and out of it, in favor of working out a solution of this problem, and we are perhaps justified in looking forward to a more effective and satisfactory régime in the years to come."

Hospital and dispensary practice has changed with improvement in the average economic status of the public. Today there are comparatively few destitute persons. Hospital patients were formerly seldom asked to pay anything; now some public hospitals collect money from as high as 80 per cent of their patients, and it is difficult for a person unable to pay something to gain admission to some of them. The hospitals are, however, rendering far better service to the sick than was formerly given. The "free dispensary" as we knew it twenty years ago has practically ceased to exist. Excepting the municipal dispensaries few fail to charge

a fee for admission; medicine and special treatment and Roentgen ray and other laboratory examinations are subject to additional charges. These fees have steadily advanced, so that now many dispensaries ask twenty-five cents per consultation, a number charge fifty cents and some have charged one dollar for the past year or more. At the same time it is doubtful if dispensary patients generally receive as good service as they formerly did. Whereas in former generations the masters of our profession worked in the dispensary for many years, it has become increasingly difficult to secure the services of competent physicians for dispensary work. The number of hospital appointments is far larger, but I think the chief reason for this situation is that so many salaried positions have arisen with insurance companies, banks and industrial concerns. Also the cost of living and maintaining an office has outstripped the moderate increase in fees. In any event, many dispensaries have been forced into paying salaries to their professional staffs. Another very important factor is the deplorable inadequacy of the physical facilities afforded physicians for dispensary work, and, as Dr. Corwin writes, "The dispensary has too often been treated as a Cinderella in the hospital household—neither sufficient funds nor sufficient thought have been given to its organization and work." The equipment is often most meager and there is a surprising lack of laboratory facilities. Physicians waste much of their time in work which could be better done by lay secretaries, and the records are of little or no value.

For these reasons the teaching of students has been largely transferred to the hospital wards, although the material there is doubtless less instructive. There are, however, evidences that the importance of the dispensary in promoting the public health is again being appreciated, and I imagine that it may some time, perhaps soon, supplant the hospital as a community agent, for it seems clear that it is destined to cover the major portion of medical service.

In 1918 the Public Health Committee of the New York Academy of Medicine instituted a survey of the dispensary situation in

New York, and in 1920 published a report and made many valuable recommendations for improvement. Perhaps the most significant finding of the committee was that 80 per cent of dispensary patients came with complaints which are taken care of in departments other than internal medicine and general surgery. This is equivalent to saying that by a process of evolution conditioned by economic, medical and public health forces the dispensary has become an institution to which a large part of the wage-earning class of our population resorts when in need of specialists or of special examination or treatment, which in the majority of instances they cannot obtain except at the dispensary.

The report continues: "The recognition of this condition calls for a reconsideration of the whole dispensary problem from the standpoints of economics, administrative policy and the relation of the medical profession to the dispensary. 'Intimately bound up with any plan or reform of the existing practices that might be undertaken is the question of dispensary fees and that of pay clinics." Among its recommendations the Committee on Public Health included "the promotion of pay clinics, which are urgently needed," for the reason that "under existing conditions those unable to pay the customary fees of specialists or to meet the expense of laboratory and roentgen-ray examinations and of special treatment are compelled to resort to the dispensary, although they may be in a position and willing to defray a part of the costs prevailing in private practice."

As a result of this report the United Hospital Fund formed a Committee on Dispensary Development, which secured a large sum for aid in improving dispensaries, and as a part of its activities the Committee has coöperated with the Cornell University Medical College in establishing a pay clinic which has been operating since November 1, 1921. The agreement provides that Cornell University shall bear the annual deficit in the cost of operation up to the amount previously expended for its dispensary ($21,000), beyond which amount the committee undertakes to carry it, within certain limits, during the first two years.

The decision to reorganize the dispensary was only reached

after thorough study of the situation by the faculty and consultations with many leading physicians, educators and economists. The principal reasons for reorganizing may be summarized as follows:

1. To provide better clinical material, thoroughly studied and properly recorded for teaching purposes.

2. To coöperate with physicians in securing an accurate diagnosis for their patients who cannot otherwise procure the services of specialists and laboratory investigations.

3. To advance scientific investigation into the problems of disease, particularly its beginnings.

4. To provide opportunities for recent graduates of the college to pursue clinical and laboratory studies under its auspices and to receive sufficient compensation therefor, so that they will not be diverted to other fields which often pay more but inhibit development.

5. To render a needed service to a large group in the community.

The college aims to provide, so far as possible, ideal conditions for facilitating the work of the professional staff, and $20,000 has already been spent on equipment and alterations. Also the executive and administrative staff, numbering seventy-five, which includes nurses, clinic executives and stenographers, is designed to relieve the doctors from every detail which can be properly performed by lay workers. The guiding principle in its operation is to provide every facility for careful investigation and treatment to the end that the patient will receive the best possible service.

The clinic is designed for self-supporting persons who cannot afford the fees charged in private offices, particularly by specialists or for diagnostic consultations and laboratory and Roentgen-ray work. The basic fee is $1 a visit; medicines, Roentgen rays, extensive laboratory service and appliances are furnished at approximately cost. The clinic includes a diagnostic service for patients referred by physicians at a fee of $10, which includes a report and recommendations for treatment to the referring physician.

The chief of each department decides how many new and how many old patients can be properly handled by each member of his staff per session and patients are not admitted in excess of that number. The amount of time allotted to a patient varies considerably in the different departments. Internal medicine, neurology and psychiatry assign forty-five minutes to every new patient and fifteen minutes to old ones. Fifteen minutes is the least time assigned to any patient. They usually come according to an appointment previously arranged by the executive staff and waiting time is thereby reduced to a minimum. This system obviates the usual hurry and congestion and allows the physicians plenty of time to properly study their patients, and, which is a very important factor, gives an opportunity for a display of human interest, which is so keenly appreciated by the patient and seldom observed in dispensary practice.

The faculty of the college exercises direct supervision and control over the work in all departments, and certain senior members of the various departments are in daily attendance. Some of them are finding that the dispensary is more attractive than the hospital and devote considerable time to the clinic. Because of the teaching in its various forms, which is being constantly conducted in the clinic, members of the faculty are available for consultations every day. We have attempted to so correlate the various departments, including the laboratory divisions, that every necessary examination and investigation can be secured with the least possible effort on the part of the physicians.

Great care is exercised in the admission of patients to prevent abuse by those who can afford to pay the fees of private physicians. Everyone is submitted to a searching examination into his means, the decision regarding admission being based on the relation between the patient's income, his responsibilities or obligations and the cost of the needed diagnostic or therapeutic procedure. Those needing hospital or surgical care are sent to institutions with which our staff is affiliated, provided they cannot afford to pay for professional service. If they are able to pay they

are given the names of three physicians holding appointments on the staffs of representative hospitals, but in no case are they given the name of any physician connected with the clinic or the college, and the staff is not allowed to attend any clinic patient outside of the clinic. Under no circumstances are patients referred by outside physicians given treatment in the clinic unless a definite request to that effect is made by the referring physician. Since November 1, 1921, 308 people have come to the clinic, frankly stating that they wanted the advice of physicians and were willing to pay whatever charges were necessary. There was no attempt on their part to conceal the fact that they were able to pay a physician's fee; they were seeking relief rather than economy.

The attending physicians are classified as follows:

1. Chiefs of clinic, who are mature, well-trained men.
2. Chiefs of subdepartments or divisions.
3. Attending physicians.
4. Provisional appointees, who act as voluntary assistants and are candidates for regular appointments when the size of the department in which they work justifies additional paid workers.

Excepting chiefs of clinic the compensation is based upon the number of sessions attended by the physician each month. The annual compensation varies between $500 and $2000, depending upon the rank of the physician and the amount of time devoted to the clinic.

The experience of the past five months of operation appears to justify the existence of the clinic on the grounds above mentioned. Applications far exceed the capacity and the material for teaching purposes has been vastly amplified. The attendance averages 350 at each session. It was feared by some that this class of people would not so readily accept utilization for teaching, but it will be recalled that, generally speaking, the more intelligent the patient the better his coöperation, and we are experiencing no difficulty in this regard. That there is a great demand for such service on the part of the public is evident.

It also is evident that there is considerable demand for such

service on the part of the medical profession, as the number of referred patients is constantly increasing. 365 physicians have referred 590 patients, and one has sent 25 for diagnostic surveys.

It is too soon to see any positive results from the exceptional opportunities afforded the attending staff for scientific investigation, but plenty of time for studying patients, a system of records comparable with the best hospitals and the free use of the various laboratories and their staffs will certainly result in productive work.

One of the most important aspects appears to me to be the holding of our recent graduates in an atmosphere of scientific medicine. We are in a position to afford these young physicians an opportunity for clinical work under competent supervision, for which they will receive a modest compensation and at the same time enable them to continue work in some of the laboratories, usually in connection with some clinical problem.

Up to the present time our experience is quite in accord with that of other dispensaries, in that 80 per cent of the patients seek a specialist's advice, and fully one-half of the remaining 20 per cent require a specialist's opinion before a proper diagnosis can be made in the departments of medicine or surgery.

A recent survey of 500 cases shows that only 10.8 per cent were suffering with acute illnesses; 86.6 per cent were classed as chronic and 60 per cent stated that the trouble for which they sought relief had existed one year or more.

The question naturally arises whether a clinic such as ours should confine itself to diagnostic work or give treatment as well. It appears likely that diagnostic groups may render valuable service to those people who are able to follow out the recommendations for treatment under the direction of competent practitioners or specialists. I doubt, however, if the diagnostic clinic alone goes far enough in meeting the needs of the class of people for whom the "pay clinic" is designed. The establishment of a diagnosis is of little service to the patient unless he can have the necessary treatment subsequently.

Having this in mind an attempt was made to estimate the

probable duration of treatment, and in the series studied it was estimated that:

Treatment would be needed for less than one month in 20 per cent.

Treatment deemed necessary for an indefinite period in 63 per cent.

Operation advised in 11 per cent.

Undetermined, 6 per cent.

It appears evident, therefore, that if we confine our work to diagnosis we would but partially meet the needs of this large group of patients.

It is obviously vital that the position of the general practitioner be not overlooked in this connection; he is and will continue to be the backbone of the profession. By treating patients at the clinic some will undoubtedly be diverted from physicians who would treat them for the fees which we charge, but so do all hospitals, dispensaries, public health clinics and medical services provided by employers divert patients. On the other hand, every public health movement, such as tuberculosis and venereal disease campaigns, and all agencies which teach the conservation of health very properly divert patients to the doctors. Few general practitioners or specialists can afford to give the best service of which they are capable for the fee which we charge, and the public demands the best service whether it pays much or little.

I have already stated that less than 20 per cent of our patients are treated in the departments of medicine and surgery and only about 20 per cent of those cases represent acute conditions. It is therefore obvious that few patients will be diverted from the general practitioner.

It is perhaps unnecessary for me to state that Cornell University has not made and never expects to make money from its pay clinic. I mention this only because the implication continually recurs. If it does approximate self-support the first change will be to increase the compensation of the professional staff.

The monthly operating deficit thus far has been:

November, $2745.71; December, $2035.84; January, $2029.69; February, $4538.69; March, estimated, $3000.00. Total, $18349.33.

These amounts are in addition to the sum of $20,000 previously mentioned as having been expended for equipment and alterations.

It is apparent that pay clinics will at most serve only to ameliorate the strain existing between the public and the medical profession. It seems obvious that they do fill a need, however, and I am gratified that the Executive Committee of the Eastern Medical Society agrees with this. It seems to me that the best way to forestall the advent of state medicine is to provide satisfactory medical service for all classes of people.

At Cornell we feel that the experience of the past five months in operating the pay clinic has thus far justified its existence. It is still in the experimental stage, however, and many rearrangements and adjustments remain to be made before it will function with complete satisfaction. Funds have been provided so that it will be possible to continue the experiment for a period of two years, and at the end of that time if it has not fully justified itself we shall abandon it. If it does not operate for the best interests of the community at large, which includes the medical profession, Cornell University has no desire to continue its existence. I think that the final decision in this and in similar questions will be made by the public, and if a thing is best for the public welfare then the medical profession should be ready to support it.

DISCUSSION

Dr. H. R. M. Landis: I have been very much interested in the subject that Dr. Niles has presented. For several years past we have considered at the Phipps Institute how the Institute could be made to serve the public more generally than it does. We have a diagnostic clinic there at the present time which is a pay clinic, and recently we resorted to the expedient of publishing a *Bulletin* devoted to topics which we thought

might serve the general medical profession. Everything Dr. Niles said I can vouch for. I spent three days at the Cornell Clinic and saw the whole scheme in operation exactly as Dr. Niles has described. What he did not say was that it is the most extraordinarily developed piece of executive machinery that I have ever seen. He has told you of the multiplicity of specialties, the corps of physicians at work and the number of patients in attendance. Somebody who preceded me commented on the fact that the type of patient in the waiting room was entirely different from the patient we are in the habit of seeing in the dispensaries in Philadelphia. That is true. The patients who attend this Clinic are, for the most part, individuals who are moderately well-to-do and show none of the evidences of poverty and misery that are so conspicuous in many of our dispensaries. In regard to the financial status of the patients, so far as one can judge, the income which makes an applicant eligible has been worked out with a great deal of care. This is based upon what the social worker obtains from the patient coming into the dispensary. To check up the reliability of these answers the first 500 patients are being visited in the home in order to determine whether the patient had given a perfectly clean-cut story as to his financial responsibility. This report will be available shortly. There were several instances on the days I was there in which the question arose as to whether patients should be admitted. When the income is in excess of that fixed by the clinic the patient is referred back to his or her doctor. In the case of their having no physician a list of these men, not connected in any way with the clinic, is furnished the patient. He must choose which one of the three he will consult.

The great majority of the patients come with the story of a long-standing illness for which they have obtained no relief.

We have had the feeling at the Phipps Institute for some time that the public and profession with which we have been associated should be able to avail themselves of its service more than is at present the case. There ought to be some way in which the laboratory and clinical facilities are more generally available. Under present conditions we are treating about 80 per cent of foreign-born poor unable to pay anything; in addition there is a large Negro clinic not paying anything. Perhaps some scheme might be evolved for afternoon hours, at which time we might receive the type of patient treated at the Cornell Clinic, so that they might obtain the benefits which these destitute people are getting in the morning for nothing. At the present time this is to be looked upon as a medical sociological experiment. It is interesting to note that it is meeting the fate that pretty nearly all similar ventures have encountered, namely, a wave of protest in the beginning, some of which is made without considera-

tion. So far as I can make out most social experiments that have been started have had somewhat the same fate, and yet they have all managed to weather it. What we considered rank heterodoxy ten years ago is perfectly orthodox today.

I think that one is safe in saying that the great majority of ordinary diseases can be detected by the man who utilizes the information he has acquired through education and training, the use of his special senses and the simpler tests. The unfortunate fact is that there is a very considerable group which makes no pretence of doing anything of that sort at all in practising medicine, but aim their treatment at the first dominant symptom the patient mentions and then prescribe some symptomatic remedy. I do not think any man who practises the right type of medicine has anything to fear from these clinics. The man who practises the reverse has a great deal to fear, because the public is going to quickly learn that they can get efficient service elsewhere.

I do not know about other cities, but I know of Philadelphia in this regard: The dispensary attendance rises in hard times and falls in prosperity, and I believe it to be true that the public, generally speaking, prefers going to a private physician rather than to a clinic, providing they are given adequate service. Therefore, I do not think there is any danger of the public taking advantage of this type of clinic, in spite of the fact that there has been some criticism that free clinics are filled with people who could afford to pay a practitioner. It may be that this method will have to be modified very decidedly. In my judgment it will eventually establish its right as a sociological necessity and will survive. Furthermore, I have a very strong feeling that the medical profession is the one to mold and formulate what this type of clinic should be and not allow it to be forced on us in some less desirable form.

Dr. James M. Anders: The paper of Dr. Niles was both interesting and instructive. It is clear that a diagnostic clinic can be made profitable, and it would appear that it is likely to become popular for the reasons advanced by Dr. Landis. One fact has not been emphasized to the extent that, it seems to me, it might have been, namely, that the ranks of the general practitioner have in recent times become more and more thinned out for certain well-known reasons. For example, the rapid rise of the educational standards in medicine during the past two or three decades, of the greatly lengthened course of instruction and the much higher cost of medical education are among the causes. As a consequence, recent graduates have felt themselves forced to enter more promising fields than that of general medical and surgical practice. Again, the general practitioner who does not, and indeed cannot, as a rule, keep in touch with

modern instruments of precision, and cannot procure them on account of their high cost, naturally retrogrades, and young men upon entering the profession are loath to take up general work, realizing the unfortunate situation in which the practitioner under the old training has found himself. As a consequence, a large mass of human society, especially that portion which is ministered to by the general practitioner, receives inadequate and often inferior professional service.

The principal remedy for this defect in the modern program is a diagnostic or pay clinic, rightly organized and conducted, as, for example, has been done at Cornell University. Not in any spirit of criticism, but merely by way of suggestion, in my views the patients applying should be examined first by the internist, who usually finds something basic, often of moment. At all events, I want to throw out the idea that all cases should first be examined by a good internist, as the one best fitted to recognize just what their needs actually are, and he should then refer them to the proper special department or departments.

We all know that patients for whom these pay group clinics are intended are neither the very poor nor the very rich, since the latter, as stated by Dr. Niles, are cared for; they are people of moderate or small means, who are self-supporting and want to pay, but are unable to pay, where their cases require thorough investigation, a group of specialists. Someone has said that the answer to all of this is that the specialists of today are charging too high for their services. I doubt the correctness of this view. I feel that the skilled specialist is entitled to the customary fee charged at the present day. It seems to me that the profession should no longer hesitate to organize and properly conduct these pay clinics here in the East as they are doing in the West, in order to meet the demands of a large element of the public.

Dr. John H. Musser, Jr.: There are one or two phases of Dr. Niles's paper that I want to discuss, and discuss these very briefly. I do not think, in the first place, that there is any question that this Cornell Clinic is a very distinct advance in medical sociology. I believe that in the institution of these clinics and in their proper management their spread and growth throughout the country will probably be the answer to the possibility of there being state medicine nationalization of the medical profession. In other words, I think if a sufficiently large number of these clinics are formed by hospitals, teaching institutions and so on that there will not be a tendency to organize these clinics by uncontrolled individuals, nor will there be a tendency for the medical profession, as a whole, to become nationalized. There is one little phase about this question of pay clinic that the average man, not conversant with dispensary work, does

not fully realize, that is the difficulty of securing assistants qualified and able to carry on the proper type of work. As Dr. Niles said, it is perfectly obvious why such a condition has arisen. Industries throughout the city, and I presume throughout every city and country, are demanding tremendous numbers of young men who work either as assistants or physicians of these organizations for a very large salary for the amount of time they give. These men are lost entirely to scientific medicine and teaching. They do not care particularly about hospital connections, and it is therefore extremely difficult to get dispensary assistants. You can hardly blame them, because they can spend the same amount of time at work fairly remunerative. Hospital managers and heads of departments should realize the difficulty in getting men to take these minor subsidiary positions in dispensaries.

Dr. Ward Brinton: I would like to ask whether there has been any consideration of the possibility of having outside consultations? For example: The patient being ill at home and unable to come to the clinic and the family physician desiring a consultation, whether there has been any thought of consultant being sent from the clinic? This in order to provide expert opinion at a low rate—to poor patients—at the request of their physician.

Dr. Nicholson: I have been greatly interested in this paper. As Dr. Anders has said, this matter of the establishment of a "pay clinic" has been under most earnest discussion in the Graduate School of Medicine of the University of Pennsylvania. It does not seem to me that the rights of the general practitioner of medicine need to be so carefully guarded as some think. If the relatively small number of incompetents are inconvenienced it is a good thing, while it is most certain that the large number of competent men will welcome this innovation as soon as they realize the advantages which will accrue to them and to their patients. I believe that the scheme which we had under consideration at the Graduate School is in one respect better than that advanced by the speaker, since we had decided not to accept any case unless referred by a physician, and that no treatment should be given, either operative or medical, unless the physician who referred the case desired it. There is not the least doubt in my mind that such a clinic would receive the enthusiastic support of outside physicians, provided that it is run in an honest and fair spirit.

Dr. Walter L. Niles (closing): I am very grateful for the discussion this evening. We at Cornell are seeking enlightenment on all sides, and

this has been very helpful. We have received considerable advice from unsolicited sources which has not been helpful, and it is very pleasant to be in such a friendly atmosphere as I find myself tonight. In reply to Dr. Anders's question, I would say that I meant to state that 80 per cent of the patients were eventually assigned to special departments. Many of these had been through the department of internal medicine before assignment, and we would like to have all cases reviewed by the medical department. This seems impossible, however, as medicine represents the neck of the bottle, being the chief feeder to all special clinics, and each case requires a long period (at least forty-five minutes) for the initial history and examination. Replying to Dr. Brinton's question, we have not considered the possibility of consultations outside the clinic. In the first place our staff is fully engaged with the present work, and in the second place I think that such a practice would be fraught with many hazards in our relations with the outside practitioners. However, it is a point that deserves further consideration. I believe that we are doing good work at the Cornell Clinic and that the quality of the work will improve as time goes on and the several departments become better coördinated. I think that the pay clinics have come to stay, but believe that they should be conducted under the supervision of large hospitals or teaching institutions. Allowing small groups of practitioners to run such clinics would probably bring back the old dispensary evils when they were chiefly to foster private practice.

A pay clinic must not be run as a money-making concern for the medical profession, directly or indirectly. I would like to make it clear that our deficit for the first year of operation will probably be between $40,000 and $50,000. There are many problems to be solved and readjustments to be made before the pay clinic will be on a sound basis. I thank you very much for the aid which you have given me.

THE THERAPEUTIC USE OF DIGITALIS AND ITS RELATION TO EXPERIMENTAL PHARMACOLOGY

The Mary Scott Newbold Lecture

LECTURE VIII[1]

By G. CANBY ROBINSON, M.D.
BALTIMORE, MARYLAND.

It is my purpose this evening to recount the present state of our knowledge concerning digitalis and to point out the relative importance which animal experimentation and clinical study have to the development of the present-day conception regarding the therapeutic use of this valuable drug. I wish to emphasize particularly the part that observations on patients have played in this development, but in so doing it is not with the idea of minimizing the value of the pharmacological laboratory, but with the hope of demonstrating the necessity of carefully planned investigations of the action of drugs on patients together with a thorough study of the diseases with which they suffer.

Animal experimentation has too strongly dominated the ideas concerning the results to be expected when digitalis is administered to patients with heart or circulatory disease. Recent observations on patients by methods which allow an accuracy quite comparable to that of animal experimentation make it clear that the predominating effects by which the beneficial results of the drug are produced are not those predicted by animal experi-

[1] Read April 5, 1922.

ments. As pointed out by Cohn,[1] clinicians have been too much influenced by the results of animal experiments and have expected to observe in patients effects that are similar to those described by the experimental pharmacologists. When such effects did not occur the clinician has too often attempted an explanation by finding fault with the potency of the preparation or by assuming an idiosyncrasy in the patient. The conditions of experimentation are quite different from those under which the drug is administered to patients, and there has been also a great difference in dosage. Patients, although they may suffer with what may be generally called heart disease, also present many different types of clinical conditions. These and other reasons which will be pointed out later are the causes why experimental and clinical results are not in accord and why it is necessary to depend mainly on the facts derived from clinical studies in endeavoring to reach the correct conceptions regarding the therapeutic use of digitalis. The introduction of digitalis as a remedy by William Withering[31] in 1785 was the result of a careful, accurate, clinical study. His book entitled *An Account of the Foxglove and of its Medicinal Uses, with Practical Remarks on Dropsy and Other Diseases,* well deserves the place it holds among the medical classics, not only because it served to bring forward this valuable drug but also because it reveals an attitude of mind which should stand as a model for all who advocate any new therapeutic agent. This attitude is shown by these words from this book: "It is much easier to write upon a disease than upon a remedy. The former is in the hands of nature, and a faithful observer, with an eye of tolerable judgment, cannot fail to delineate a likeness. The latter will ever be subject to the whims, the inaccuracies and the blunders of mankind." Recognizing the difficulties which surrounded his work, Withering exercised remarkable care to avoid the dangers that he foresaw.

He relates the oft-repeated story of how he became informed of a secret remedy by which an old woman of Shropshire was often able to relieve and cure patients with dropsy to whom no help could be given by some of the leading medical men of the day.

He obtained the formula which she used, consisting of some twenty herbs, and from his knowledge of medicinal plants he concluded that the foxglove was the one whose action was beneficial. Withering's book was written after a clinical study of the drug lasting over a period of ten years. He gives an account of 163 patients to whom he had given the drug and also publishes communications from other physicians to whom he had told of his early results. He states that in order to prevent any unwarranted enthusiasm for the drug he has reported all patients to whom the drug was given without selection, and warns his readers from being led astray by the communications of other physicians from whom he had received reports of selected cases.

The case reports are concise, clear and graphic, but, strange to say, deal largely with the diuretic effects of the drug and the disappearance of dropsy. Withering observed the fact that digitalis slowed the pulse, especially in large doses, but he did not associate this effect with the benefit of patients suffering from heart disease. In fact, it is evident that he considered the diminution of the heart-rate as a sign that the maximum dose of the drug had been given, for he says, "Let the medicine be continued until it either acts on the kidneys, the stomach, the pulse or the bowels; let it be stopped upon the first appearance of any one of these effects." This is sound advice which for many years has been disregarded.

The appearance of Withering's book one hundred and thirty-seven years ago represents the beginning of the period of the study of digitalis by direct observations on patients. The importance of Withering's observations in relation to the mass of experimental facts that has accumulated since its appearance is commented upon by Cushny.[5] He said, "More than a century after the introduction of digitalis the knowledge of its therapeutic action had made but little progress and was meager and unsatisfactory, because no accurate knowledge of the clinical action was attainable and the facts of the laboratory could not be confirmed for man." This statement, made by Cushny eleven years after he had made his own first important publication on the action of the

drug on the mammalian heart, but only a short time after he had begun to study the action of the drug on patients in the wards of Sir James Mackenzie, is significant.

The most definite reason for the delay in the determination of the exact relation which exists between the facts obtained by animal experiments and the action of digitalis as observed in patients with heart disease was because accurate objective analysis of clinical phenomena had not been developed. The effects of the remedy long remained, as Withering said, subject to the whims, the inaccuracies and the blunders of mankind. Withering thought it would ever be so, but, as a matter of fact, methods applicable to clinical study have recently been developed equal in accuracy and objectivity to those of the experimental laboratory.

These newer methods may be put into two groups: In the first group belong those methods that give accurate information regarding the movements of the various parts of the heart. In the second group may be put the quantitative clinical methods such as the accurate measurement of the intake and output of fluids, the quantitative estimation of kidney function, the measurement of blood-pressure and of the vital capacity of the lungs, together with the variety of useful quantitative methods that have been developed by the application of biochemistry to clinical medicine. All of these methods have been used not only directly in the study of digitalis in man but they have also served to differentiate with greatly increased accuracy the many conditions belonging to the general class of heart and circulatory disease, and have so added a degree of specificity to digitalis studies which was hitherto impossible.

The introduction of the polygraph by Sir James Mackenzie inaugurated the methods by which the movements of the auricles and ventricles of man can be studied separately and by which the efficiency of the conducting system of the heart can be measured. The value of this method is demonstrated by the masterly studies of digitalis published by Mackenzie[21] [22] in 1905 and 1911, which have added much to our knowledge of the action of the drug in heart disease.

The adaptation of the string galvanometer by Einthoven furnished the second great advance in this direction, and the electrocardiograph has added much to the modern concepts of digitalis action in man. In it we possess a method that not only clearly differentiates all the disturbances of cardiac mechanism, but which also gives us information of importance regarding the direct action of digitalis on the heart muscle, allows the detection of very early effects of the drug on the heart and serves as an aid in determining pathological conditions of the myocardium.

Of the methods belonging to the second group comment is necessary perhaps in only one instance, namely, the measurement of the vital capacity of the lungs as a means of studying the effect of digitalis. Several years ago Peabody showed that the vital capacity of the lungs (amount of air measured by a spirometer which can be forced from the lungs after the deepest possible inspiration) varied directly with the efficiency of the circulation. He also showed that normal individuals of the same sex, weight and height gave vital capacity readings of sufficient constancy to allow the establishment of a normal standard. West and Pratt[29] have reported a series of cases to which digitalis was administered and in which the vital capacity of the lungs was taken as one of the criteria for the estimation of the effect of the drug. Although it is not entirely clear how the improvement of the circulation causes an increase in the vital capacity, the method holds promise as a means of estimating quantitatively the functional efficiency of the circulation and may therefore fulfil, at least in part, one of the greatest needs in the study of the effect of digitalis in heart disease. This method, the technic of which is quite simple, should be included in all comprehensive studies of the effects of digitalis on man.

The effects of digitalis on man are naturally separated into those that are advantageous and those that are deleterious, especially to patients suffering from disturbances of the heart and circulation. These two groups of effects may be spoken of as the therapeutic action and the toxic action of the drug. In most instances they can be separated by the ultimate results which they produce on

the circulation as a whole, but sometimes the prevailing condition of the circulation may make this separation somewhat difficult, as effects which would be considered toxic under most circumstances may bring about under some circumstances distinctly advantageous results. Therapeutic and toxic effects may also occur simultaneously when the drug is administered in large doses to patients; and the close relation between the optimum therapeutic dose and that producing early toxic symptoms presents one of the greatest problems involved in the skilful use of the drug.

The characteristic effects of digitalis are those on the heart and the central nervous system, but in order to understand its action so that it may be intelligently employed in the treatment of disease a close analysis of its effects must be made and careful consideration must be given to the various pathological conditions it may be expected to benefit.

The first requisite for the successful employment of digitalis as a remedy is the recognition of its toxic effects, especially of those early effects which serve as indications for the discontinuance of the drug. Because of this practical significance of the toxic effects of digitalis it may not be amiss to discuss some of them briefly.

Loss of appetite, nausea and vomiting are probably the commonest untoward effects of the drug. They were clearly described by Withering and must have been observed by all who have employed digitalis in doses large enough to produce the maximum therapeutic results. Careful studies both on patients and on animals by Eggleston[8] and Hatcher[14] demonstrated clearly that this toxic effect was not the result of the direct action of the drug on the stomach, but these undesirable gastric symptoms apparently arose from the stimulating action of digitalis on the vomiting center in the medulla. The emetic action of digitalis has been further studied quite recently by Hatcher and Weiss,[15] and a preliminary report of their work has appeared. They have shown by means of a series of experiments on cats, in which various nervous structures were cut, that digitalis causes emesis only when the nerve supply to the heart is intact. Their experiments indicate

that the vomiting center is not stimulated directly but by impulses reaching it from the heart, passing up by way of the sympathetics and to a less and variable extent by way of the vagi. These investigators consider their experiments as evidence that the digitalis bodies induce emesis by reflex action due to irritation of the heart itself. This effect they consider as almost certainly a protective mechanism for the heart. With the establishment of the fact that emesis is not an effect produced by the direct action of digitalis on certain structures of the medulla but is secondary to the direct action of the drug on the heart, a new attitude must be taken regarding the relation of the gastric symptoms to the cardiac effects of the drug. Its effect on the heart and its effect in producing nausea and vomiting cannot be dissociated, and the latter would seem to have a more significant place than has been accorded it in evaluating the cardiac action of digitalis.

Although the gastric disturbances are the most obvious unfavorable effects of digitalis the cardiac disturbances must be regarded as the most serious in the clinical use of the drug. It is the direct effect of digitalis on the heart which produces death in animals to which a lethal dose is administered, and certain disturbances of the heart-beat resulting when an overdose is given to man must always be considered as the forerunner of effects of the drug which profoundly lower the efficiency of the circulation and which render the heart eventually incapable of maintaining the circulation. For this reason the early recognition of unfavorable effects of the drug on the heart is a matter of paramount importance.

The analysis of the cardiac disturbances produced by digitalis in man has its inception with the first of Mackenzie's[21] studies on digitalis published in 1905, when he described the bigeminal pulse and recognized that its production resulted from frequent premature ventricular beats. He also showed that the conduction of the cardiac impulse from auricles to ventricles is disturbed by the drug. In 1911, Mackenzie[22] pointed out that digitalis may cause irregularities of impulse production, premature beats, partial heart-block and pulsus alternans. These findings have been amply verified and extended by numerous investigations in which the more

exact method of observation furnished by the electrocardiograph has been employed.

THE THERAPEUTIC EFFECTS OF DIGITALIS. The beneficial effects exerted by digitalis upon patients suffering from heart disease are not dependent upon a single action of the drug, but they result from a combination of effects. The relative importance of the various activities of digitalis upon which its therapeutic effects depend has been the subject of much controversy, and although this controversy has been settled in a large measure, several points remain about which there is no unanimity of opinion. Here again it may be said that animal experimentation has added confusion in some respects to the problem of determining how digitalis benefits patients. This question can be answered finally only by the study of the reactions of such patients to the drug.

The most important point which still awaits final settlement is the influence of digitalis on the strength of ventricular contractions. The relation of the effect of digitalis on the efficiency of the cardiac contractions in heart disease seemed at one time settled. What was then the generally accepted idea is expressed by Balfour, who stated in his *Clinical Lectures on Diseases of the Heart* (quoted by Schmoll),[24] "All benefits we obtain from digitalis are inseparably connected with its tonic action; they flow from the power that digitalis has of increasing muscular activity and the improved metabolism of all the tissues, but especially of the myocardium." Schmoll interpreted this statement and his own observations as meaning that the drug acts as a specific on the tonicity of the heart muscle.

Such ideas regarding the action of digitalis on the heart muscle had their origin in and were profoundly influenced by the investigations of Schmiedeberg,[25] published in 1874. His experiments were carried out for the most part on the frog's heart and his results were interpreted as showing that the drug caused an increase in the elasticity of the heart muscle, which he considered as the effect by which the most important therapeutic results are attained. Such results were carefully looked for in a number

of recent clinical studies and no conclusive evidence that such effects occur when the drug is administered to patients has been obtained. Thus, Mackenzie[22] states in his study published in 1911 that he was unable to determine that the drug affected the heart muscle, although he admits that changes in the ventricular contractions may take place which cannot be detected. Edens[7] failed to obtain evidence that digitalis exerted an effect on the cardiac contractions and advances the hypothesis that this is because of the poor nutritional condition of the myocardium presumably present in heart disease. Cohn[1] states as a result of his clinical study of this subject that "if digitalis increases the ability of the ventricles to pump blood it does so by means of a change which is more subtle than can be distinguished by our methods." The results of my own study of patients under the influence of digitalis have been in accord with the foregoing statements, and it is safe to say that no evidence exists that can be accepted as conclusive proof that digitalis affects favorably the condition of patients with heart disease by its direct action on the heart muscle.

On the other hand it has been repeatedly demonstrated that the form of the electrocardiogram obtained from patients is altered when digitalis is administered. This alteration affects particularly the ventricular portion of the record, the upright T-wave becoming inverted. When this fact is analyzed, as has been done by Cohn, Fraser and Jamieson,[3] it does seem to be conclusive evidence that the drug acts directly on the heart muscle when given to patients well within the maximum therapeutic dose. This does not, however, necessarily mean that the force of the ventricular contractions is increased.

A closely allied subject is the influence of digitalis on blood-pressure. Blake discovered in 1839 that digitalis caused an elevation of blood-pressure when administered to animals, and until quite recently this was believed to be a clinical fact. It was generally believed that the arterial pressure was raised by increased force of the ventricular contractions and by constriction of the vessels. The idea that digitalis has a direct action on the blood-

vessels has been ardently supported by numerous experimental studies by Gottlieb and his students. The papers by Kasztan,[18] Jonescu and Loewi,[16] Fahrenkamp[12] and Joseph[17] are interesting and ingenious studies and indicate that the vascular responses, sometimes dilatation, but usually constriction, vary with dosage and are quite different in the vessels of different organs. However, it is clear that the facts which these investigators brought out cannot be transferred directly to explain the action of the drug on man. Eggleston[10] has published a critical review of this series of papers. He points out especially the great divergence in dosage under the two conditions and says, "It must be quite obvious to anyone who gives the matter a moment's thought that it is utterly fallacious to reason from such experiments that similar effects would be produced in man from the therapeutic use of digitalis."

Eggleston has analyzed the results reported by ten students of this subject and finds that of the 181 cases which they report the systolic blood-pressure was raised in 36 per cent and fell in 31 per cent after the drug was given in apparently sufficient quantities, while in 31 per cent no effect was observed. The diastolic pressure rose in only 20 per cent, fell in 15 per cent and was uninfluenced in 65 per cent. To these studies Eggleston added a carefully planned and controlled set of observations of his own. He found that the drug when given in maximum doses has very little influence, as a rule, on the systolic blood-pressure, while it tends to produce a significant reduction in the diastolic pressure, thus having a material influence on the pulse-pressure. He seems clearly warranted in his conclusion that there is no evidence that digitalis has any direct action on the bloodvessels when given to man in large therapeutic doses. Windle,[30] Lawrence[19] and Danielopolu[6] have expressed the opinion that digitalis is of value in cases with artery hypertension. The last writer reports a series of 36 such cases treated with the drug and observed a reduction of the systolic pressure in 19 and of the diastolic pressure in 24 patients. In a study of 100 cases of heart disease[23] in which I gave digitalis in very large single doses it was noted that the systolic pressure

tended to approach more nearly the normal level after the drug was given. In other words, elevated blood-pressure fell while abnormally low blood-pressure tended to rise after the drug was given. These observations are in accord with those of Eggleston.[10]

It is by no means desirable that the state of the blood-pressure should be ignored in determining the indications for the use of digitalis or in studying its effects on man, but the older ideas which were largely developed from the results of animal experiments must give place to those resting upon the accurate clinical studies that have been made since the introduction of the sphygmomanometer. Arterial hypertension must not be accepted as a reason *per se* for withholding the drug from patients when it is otherwise indicated.

The Use of Digitalis in Heart Failure. Digitalis has attained the reputation of being the most valuable drug in the treatment of heart disease, and by the term heart disease is usually meant a group of symptoms such as dyspnea, cough, chest pain, edema, cyanosis, weakness and palpitation. These symptoms are in reality not evidence of heart disease but of heart failure, and they occur as a group only when the heart is unable to maintain the normal circulation of the blood. Heart failure may result from a variety of cardiac disorders, some of which are much more susceptible to a favorable influence by digitalis than others. The great reputation of the drug in heart disease doubtless rests upon the striking benefits which it produces in cases of heart failure associated with one particular type of cardiac derangement. On the other hand fault has been found with the drug when it has been used in heart failure dependent upon other causes with the expectation that similar results are to be obtained. In considering the therapeutic use of digitalis it is just as necessary to take into account the various cardiac derangements responsible for heart failure as it is the various actions of the drug. In fact it is only when these two aspects of the subject are brought together that a rational basis for the therapeutic use of digitalis can be established. It is undoubtedly because clinicians have not fully understood the action of the drug and because pharma-

cologists have not fully understood heart failure that so many misconceptions have existed in the past regarding the therapeutic use of digitalis.

The one particular type of heart failure in which digitalis is of great and undoubted value is that associated with the frequently encountered condition, auricular fibrillation. It has been repeatedly shown that its value in this condition lies in the fact that it slows the abnormally rapid and irregularly beating ventricles, and this effect of the drug is generally considered its most important accomplishment. Lewis[20] has recently expressed what is an extreme view of this matter. He says: "The chief value of digitalis lies in its power to control the ventricular rate when fibrillation of the auricles has come. In most patients in whom this disorder of the heart is discovered the ventricles beat rapidly at rates of 120, 140, 160 and even more per minute. It is this rapid action which fatigues the heart, and digitalis by lessening the rate, lessens the fatigue.

"The reduction of accelerated ventricular rate is the only important action of the drug upon the human heart of which we have knowledge. There are few if any instances of which we know with certainty in which digitalis acts beneficially except cases of accelerated action; there are few instances of acceleration in which the drug produces unquestionable benefit apart from those provoked by fibrillation of the auricles.

"The principle of digitalis therapy—and when I speak of digitalis I include the allied drugs strophanthus and squills—is that, administered to suitable cases, the heart, by means of it, obtains rest. The giving of this drug to unselected cardiac cases is much to be deplored. Those who regard digitalis as a cardiac stimulant mistake its character; its chief action is to rest the heart. To the heart foxglove is not tonic, but powerfully hypnotic. It extends the diastoles of the heart; it extends the period of sleep."

Although most students of digitalis do not share entirely the idea of Lewis regarding the relative uselessness of the drug in conditions other than auricular fibrillation, he has well expressed the consensus of opinion regarding its value in auricular fibrillation.

The slowing of the heart is brought about by a different mechanism than that by which digitalis slows the normally beating heart, to be discussed presently. When the auricles are fibrillating stimuli are sent down to the ventricles unrhythmically and at a rate much higher than that of the normally beating auricles. Digitalis depresses the conductivity of the pathway between the auricles and ventricles, which then allows fewer stimuli to pass. In this way the rate of the ventricles is slowed and the arrhythmia reduced. This effect is very desirable, because the rapid, irregular ventricular activity which the fibrillating auricles engender is much less competent to maintain the circulation than the normally beating heart, and the ventricles become more competent when they are slowed and regulated by digitalis. The depression of conduction in auricular fibrillation is brought about both by the stimulation of the vagus nerves and by the direct action of the drug on the conducting mechanism of the heart. The relative importance of these effects is as yet not clearly determined. Nor is it decided whether other effects of the drug, such as the improvement of the ventricular efficiency, plays any part in its beneficial action in this condition.

The fact that digitalis is especially useful in a type of cardiac derangement which almost never occurs spontaneously in laboratory animals is an obvious reason why the experimental pharmacologist failed to establish a satisfactory basis for the therapeutic use of the drug.

A similar example may be cited in the value of digitalis in cases of auricular flutter. In this condition the drug has proved of definite value, principally because of its ability to cause this type of auricular activity to pass over into auricular fibrillation, which in turn tends to revert to the normal cardiac mechanism. This effect of digitalis could never have been suspected from the facts derived by animal experimentation, and was found to be one of the benefits possessed by the drug only after auricular flutter had been discovered, studied and treated in patients.

The mechanism by which digitalis benefits patients with heart failure in whom no permanent derangement of the cardiac mechan-

ism exists is a question to which no clear answer can be given at present. When the heart is beating regularly and each ventricular contraction is stimulated by the normal contraction of the auricles it is evident that the conditions are quite different from those that exist when the auricles are in a state of fibrillation. A part of the controversy regarding the action of the drug on the regularly beating heart is centered about the question of its ability to reduce the cardiac rate, and this can be adequately answered.

Reduction of the rate of the heart-beat was the first digitalis effect to attract attention in experiments on animals, and these observations dominated the conceptions regarding the therapeutic use of the drug. Digitalis has been used by physicians for many years with the expectation of slowing the heart-rate of patients in the same manner in which slowing is produced in animals. It is true that the reduction of the accelerated cardiac rate is without doubt the most important effect of digitalis in heart disease, and this valuable effect occurs in a striking manner when auricular fibrillation is present. But it is essential to draw the distinction between the action of the drug on the normally beating heart and on the heart in which the auricles are in fibrillation. It is only when these two conditions are differentiated that reliance can be placed upon statements regarding the influence of digitalis on the cardiac rate in heart disease. As it was not possible to determine with certainty the existence of auricular fibrillation before the employment of the electrocardiograph, only the literature of approximately the last decade can be said to furnish reliable evidence on this point. In regard to the question under discussion, namely, the ability of digitalis to slow the normally beating heart, divergent opinions have been expressed by those who have investigated it. Wenckebach[28] states that the regularly beating heart is slowed by the action of digitalis on the vagus nerves and compared its action to the effect obtained by stimulation of the vagi by pressure over their trunks in the neck. On the other hand the drug was found to have almost no effect in most cases with normal rhythm in the series carefully studied by

Mackenzie.[22] He observes occasionally, however, striking slowing of the cardiac rate in cases with normal rhythm following the administration of digitalis. Cushny[4] observed slowing of the heart in 6 of 18 patients with normally beating hearts to whom full doses of digitalis were given. Cohn and Fraser[2] have reported repeated observations on the effect of digitalis on 12 patients with normally beating hearts. Daily electrocardiograms were taken and the drug was administered until a disturbance in the rhythm of the heart was produced, at which time the patients usually had gastric symptoms. In regard to the effect of digitalis on the heart-rate they say: "Slowing of the heart, even when the rhythm is normal, is still taken in many quarters as a measure of the efficiency of digitalis. The slowing of the heart which takes place after the onset of the symptoms of intoxication can hardly be taken to be of benefit. But before the symptoms occurred slowing took place in only one patient, and this one was the subject of abrupt fluctuations in rate without the use of drugs. Slowing was observed in five more patients, but not until two days after rather severe symptoms of intoxication had set in. Two of these patients had quite normal hearts, anatomically and functionally. It appears then that if the patients are divided into two groups, those in whom slowing occurs before and those in whom it occurs after the onset of digitalis intoxication, slowing will rarely be observed in the first group, and the slowing which is observed in the second group is an effect which can, in the long run, scarcely be desirable."

Cohn[1] believes that the rate is slowed only in a group of patients with hypodynamic hearts, and that to produce slowing of the normally beating heart is not a primary function of digitalis in therapeutic doses. This opinion is concurred in by a number of other students of the question. I failed to observe a change of heart-rate as a usual result of giving large single doses of the tincture of digitalis to approximately 50 patients with normally beating hearts, although similar doses nearly always produced striking reductions of rate in cases of auricular fibrillation.[23] On the other hand, Sutherland[27] states that he administered digitalis

to a series of children and young adults suffering from rheumatic heart disease with rapid cardiac rate. He found that the drug caused slowing of the rate practically uniformly, and the results in these cases were as definitely good as is usually seen in cases of auricular fibrillation.

In our own clinic we have recently seen a sharp reduction of the heart-rate in a number of cases without auricular fibrillation following the administration of large doses of the tincture under conditions which apparently rule out other causes of cardiac slowing. In these cases the slowing was accompanied by increased cardiac efficiency and no toxic symptoms occurred. These cases have been carefully studied by Dr. Carter, who has shown in several instances that stimulating of the vagus inhibiting mechanism by the drug was entirely responsible for the slowing. This he did by observing that the original rapid rate was resumed when the vagi were paralyzed by atropin.

An analysis of the studies which bear on the question of the effect of the drug on the rate of the normally beating heart leads to the conclusion that, in spite of the exceptions that have been observed, the amount of digitalis necessary to stimulate the cardio-inhibitory center sufficiently to cause slowing is usually greater than the amount that can be given to patients without the production of toxic symptoms. It is for this reason that the effects so constantly observed in the experimental animal do not appear, as a rule, when the drug is used therapeutically in heart disease.

It is evident that the reduction of the rate of the normally beating heart should no longer be looked upon as an effect which digitalis should be expected to produce, although such an effect is in many cases of heart failure highly desirable. Again it may be seen how animal experimentation has led to an erroneous conception regarding the therapeutic use of digitalis, which will require much careful study and oft-repeated arguments to correct.

One other subject of the many that remain deserves at least passing notice, and that is dosage. Clinicians, furnished with many facts from the laboratory which pertain for the most part to the toxicology of digitalis, long failed to follow the sound recommendations laid down by Withering in 1789 when he said

in effect: Give the drug in doses sufficient to produce the minor toxic symptoms and "let it be stopped upon the first appearance of any one of them." For many years the drug has been used in insufficient doses, as has been much emphasized of late. To Eggleston[9] belongs the credit of determining the optimum doses in terms of potency of the drug used in relation to body weight of the patient receiving it. His studies have furnished us with a method of calculating the dosage for each individual, which has not only had a great influence on the efficiency of digitalis therapy but which has also been of valuable assistance in further studies of its action on man. By following Eggleston's[11] directions the total calculated dose can be administered within a few hours and sharp, clearly defined results can be observed, thus adding greatly to the objectivity and accuracy of the clinical study of the drug. When his directions are carried out it is found that the form in which digitalis is given is a minor consideration, provided the potency of the drug is known and it is properly absorbed.

It is fully realized that there is perhaps no other drug in use today which affords so many examples of the importance of placing reliance on clinical observations by accurate objective methods rather than on the results of animal experimentation in order to reach true therapeutic conceptions. It should be the aim of all students of disease and its treatment, however, to do for other drugs what has been done for digitalis, namely, to separate the wheat from the chaff, discard the useless, hold fast to the useful and especially bring into closer relationship the action of drugs and the pathological physiology of human disease. Both must be better understood, and the closer these two types of knowledge approach the more hopefully can we regard our therapeutics of the future. This can best be done by intimate coöperation of clinician, pharmacologist, chemist and pathologist. Much remains to be done, and until much is done the physician will continue to be held in less esteem by many people than are the cultists, the quacks and the charlatans.

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A CONTRIBUTION TO THE CLIMATOLOGY OF TUBERCULOSIS[1]

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One of us (Bullock) came West for tuberculosis in 1898. He had been advised by the late Dr. Janeway, of New York, to do so. At the same time he was counseled against coming, and was told he would have as good a chance of recovery in New York as anywhere, by the late Dr. Baruch, of New York. So as early as 1898 the anticlimate campaign had started. Throughout the ensuing years the voices raised against climate in tuberculosis have grown in volume until the opposite opinion has been to all intents silenced. There is still here and there a physician who gives his patients a first chance to go West, and the people themselves still go West for tuberculosis regardless of medical opinion to the contrary. Otherwise we could not continue to do our work, and this in spite of an active campaign to keep them from going. The actual facts upon which the anticlimate propaganda has been conducted are very illusive and seemingly are a matter of opinion. It is also true that those holding that climate had value supported their claims by opinions rather than facts. Opinions and general statements unsupported by facts are not only valueless but dangerous in medicine. It is a frequent experience to

[1] Read May 12, 1922.

hold medical opinions for long periods, and when the time is propitious for extracting the meat from actual records to suddenly be confronted with facts which completely invalidate the pet idea of years. Every studious and thoughtful doctor has had this experience.

This paper is a record of twenty years of work in tuberculosis. It has been conscientiously, we might say prayerfully, prepared, with full realization of the responsibility incurred. This research speaks for itself. In closing this statement we add that our records are open to anyone for examination and study.

Explanation of Tables and Records. Cases 1 to 1454 inclusive, treated at the New Mexico Cottage Sanatorium, Silver City, New Mexico, under the personal supervision of Dr. E. S. Bullock, embracing the period of 1900 to 1920 inclusive, and divided into four periods of five years each, to show whether or not results improve with increasing experience and also to exhibit more clearly the value of changing methods; for instance, the use of tuberculin, applications in laryngeal tuberculosis, etc. All cases not included in statistics of results are distinguished by a heavy black line in the tabulation. In estimating percentages, fractions are almost entirely left out.*

The cases are numbered consecutively, after which the age and sex follow, and if there is a history of exposure in childhood or one of delicacy in childhood it is designated by an "x." If fever is present on admission (99° F. plus) it is shown by an "x." The systolic blood-pressure follows. Elevation of pulse (90 or above at rest) is shown by an "x." If the hemoglobin is below 80 it is shown by a "—" sign, or above by a plus sign. If the general condition is impaired it is shown by an "x." Then the Turban classification applied only to pulmonary condition is given as one, two or three. If tubercle bacilli are present in the sputum it is shown by a plus sign, and if absent by a minus sign. The presence of tuberculous complicating lesions is shown under the proper head by an "x." This is also true of serious non-

* Owing to a lack of space it has been necessary to omit Dr. Bullock's comprehensive set of tables.—Editor.

tuberculous complicating lesions, syphilis, artificial pneumothorax, tuberculin treated, unconfirmed diagnosis, arrested on admission, spontaneous pneumothorax, hemoptysis, etc. The same system is used on discharge, with the final status indicated by an "x" under the proper head. If the patient gained in weight it is shown by a plus sign, if a loss occurred by a minus sign, and a blank for no change. If treatment is less than a month it is shown by an "x." If the temperament favored a good result it is shown by a plus sign, and if unfavorable by a minus sign. The same is true of financial condition. If a laryngeal lesion healed it is shown by a plus sign, and if not by a minus sign. The length of treatment is given in months. If the patient is known to be living it is designated by an "L." If dead by a "D," and if unknown by a "U." In case of those dead the time is given in approximate years if known.

No attempt is made to classify cases as minimal, moderately advanced or far-advanced with their "A" "B" "C" subdivisions in accord with the National Association or the Sanatorium Association (though interested persons can do this for themselves), for it is an attempt to combine intensity with area which cannot be satisfactorily done, and, again, the personal equation enters it to such a degree as to make statistics based on it very unconvincing to us. Things which cannot be presented as facts had better be left out. The Turban classification is not to any such extent open to such an objection. It is based on area only and can be determined with a high degree of accuracy even without roentgen-ray plates, and with such combined with good diagnostic acumen it becomes easy to record a case as Turban 1, 2 or 3. Of course, we understand that there are cases that nothing but the roentgen ray illuminates, but they are very few. (We appreciate that a Turban 1 case can be moderately advanced, etc.) If the area of disease and the essential facts regarding any given case are clearly set forth a legitimate conclusion regarding the case can be determined. After all, what we are principally aiming at is the elimination of the tubercle bacillus from the

sputum, and that can be fixed beyond question. We all know that our closed cases do not die. It is upon this supreme test that tuberculosis work must stand or fall.

First Period, 1900 to 1905. This period comprises 116 cases, some of which were under Dr. Bullock at St. Joseph's Sanatorium, Silver City, before the New Mexico Cottage Sanatorium was established; but as they were under the same conditions and management, they are properly included to make the first five-year period complete. Of these 116 cases, 33 were under treatment less than a month, or the diagnosis was unconfirmed, or they were classified as arrested on admission. In other words, 28 per cent of all cases admitted should never have come into the institution or been sent away from home. These 33 cases are not included in the analysis of results. In 4 of the 33 the diagnosis was unconfirmed; 6 died before a month elapsed; 2 were arrested on admission and the remainder, 21 cases, were either hopeless types advised to return home or cases with inadequate finances or impossible temperaments. This leaves 83 cases to be analyzed for results. Deducting 4 cases in which the diagnosis was unconfirmed leaves 112 cases to be analyzed for status on admission.

Ninety are males and 22 are females, respectively 80 per cent and 19 per cent. Thirty-eight, or 33 per cent, gave a history of exposure in childhood. Twenty-nine, or 25 per cent, exhibited a history of delicacy in childhood, and 15, or 14 per cent, had both exposure and delicacy, and 60, or 53 per cent, gave a history of neither.

Sixty-nine, or 61 per cent of the 112 cases, exhibited fever on admission. The average systolic blood-pressure was 119.5. Ninety seven, or 87 per cent, had elevation of pulse; 63, or 56 per cent, had anemia; 94, or 83 per cent, had impaired general condition; 104, or 92 per cent, had tubercle bacilli in the sputum, leaving 8, or 8 per cent, bacilli-free on admission; 3, or 0.25 per cent, had genitourinary tuberculosis as a complication; 8, or 0.71 per cent, had intestinal tuberculosis; 20, or 17 per cent, had laryngeal tuberculosis; 7, or 0.62 per cent, had fistula-in-ano;

14, or 12 per cent, had hemoptysis under treatment; 2, or 17 per cent, had effusion; 17, or 15 per cent, had pleurisy; 3, or 0.26 per cent, had otitis media; 2, or 0.17 per cent, had miliary tuberculosis. There were no cases of meningeal tuberculosis and but 4, or 0.35 per cent, gave a history of syphilis. There was but 1 case of spontaneous pneumothorax. Seventeen, or 15 per cent, had some serious nontuberculous complication. Two, or 0.17 per cent, developed empyema. None were treated with tuberculin or artificial pneumothorax. The only laryngeal treatment used was voice rest. The average age was thirty years and eight months.

There were 16, or 14 per cent, Turban 1 cases; 29, or 25 per cent, Turban 2 cases, and 67, or 59 per cent, Turban 3 cases on admission.

There are 83 cases to be analyzed for results. In 37, or 40 per cent, the general condition was still impaired as compared with 83 per cent on admission. In but 2, or 0.26 per cent, was there sufficient change in pulmonary status to justify an alteration in the Turban classification from worse to better and in none from better to worse. Twenty-seven, or 32 per cent, were discharged still febrile as compared with 61 per cent on admission. The average systolic pressure on discharge was 122 as compared with 119.5 on admission. In 38, or 45 per cent, there was elevation of pulse as compared with 87 per cent on admission. Eighteen, or 21 per cent, showed anemia on discharge as compared with 56 per cent on admission. Fifty-four, or 65 per cent, had tubercle bacilli as compared with 92 per cent on admission.

Fourteen, or 16 per cent, of the 83 cases to be analyzed for results were classified as Turban 1; of these, 8, or 57 per cent, were discharged apparently arrested (standard definition of apparent arrest); 4, or 28 per cent, improved; 1, or 7.1 per cent, unimproved; 1, or 7.1 per cent, progressive; none dead and none quiescent.

Twenty-five, or 30 per cent, were classified as Turban 2; of these 16, or 64 per cent, were discharged apparently arrested; 3, or 12 per cent, quiescent; 2, or 8 per cent, improved; 2, or 8

per cent, progressive; 2, or 8 per cent, unimproved, and none dead.

Forty-four, or 53 per cent, were classified as Turban 3; of these, 1, or 3 per cent, was discharged apparently arrested; 7, or 15 per cent, improved; 12, or 27 per cent, quiescent; 15, or 34 per cent, progressive; 6, or 13 per cent, unimproved, and 3, or 7 per cent, dead.

Of the Turban 1 cases the present status in 6 are known to be living and the rest unknown. Of the Turban 2 cases, 7 are living, 3 are dead and 15 are unknown. Of the Turban 3 cases, only 1 is known to be living, 23 are dead and 20 are unknown.

Of the 18 cases with complicating laryngeal tuberculosis the larynx healed under no treatment except rest of the voice in 9, or 50 per cent. In 9, or 50 per cent, this complication was stationary or progressive. In 6 cases with intestinal tuberculosis 2 died, 3 progressive and 1 quiescent with an unknown ultimate result. There were 3 cases of genitourinary tuberculosis as a complication; 2 were progressive and 1 improved, and all died within a year or two. There were 6 cases with fistula-in-ano, 1 quiescent, 2 improved, 1 unimproved and 2 progressive. Hemoptysis occurred in 9, or 10 per cent. Of these, 3 were arrested, 2 quiescent, 1 improved, 2 progressive and 1 unimproved. Otitis media occurred in 3 cases: 1 progressive, 1 unimproved and 1 improved. In the 17 cases having pleurisy under treatment 5 were arrested, 3 quiescent, 1 died, 3 unimproved, 2 progressive and 3 improved.

Fifty-five, or 66 per cent, gained weight; 17, or 20 per cent lost weight, and 11, or 14 per cent, neither gained nor lost.

Of the 83 cases, 20, or 25 per cent, gave a history of exposure in childhood. Of these, 3, or 15 per cent, were discharged improved; 2, or 10 per cent, unimproved; 3, or 15 per cent, progressive; 5, or 25 per cent, quiescent; 7, or 30 per cent, arrested and none dead.

Eleven, or 13 per cent, had a history of delicacy in childhood and of these none were improved; 4, or 36 per cent, unimproved; 2, or 18 per cent, progressive; 2, or 18 per cent, quicseent; 2, or 18 per cent, arrested, and 1, or 9 per cent, dead.

Forty-two, or 50 per cent, had a history of absence of both exposure and delicacy in childhood. Of these, 8, or 19 per cent, were discharged improved; 3, or 7 per cent, unimproved; 10, or 23 per cent, progressive; 6, or 14 per cent, quiescent; 13, or 30 per cent, arrested, and 2, or 4 per cent, dead.

Ten, or 12 per cent, gave a history of both exposure and delicacy. Of these, 2, or 20 per cent, were discharged improved; 0 per cent, unimproved; 2, or 20 per cent, progressive; 3, or 30 per cent, quiescent; 3, or 30 per cent arrested, and 0 per cent dead.

Of the 83 cases considered on discharge in the first period, 47, or 56 per cent, both temperament and financial condition were favorable with the following results: 3, or 6 per cent, were discharged improved; 3, or 6 per cent, unimproved; 8, or 17 per cent, progressive; 9, or 19 per cent, quiescent; 21, or 44 per cent, arrested, and 3, or 4 per cent, dead.

In 7 both temperament and financial condition were unfavorable. Of these, 3, or 42 per cent, were improved; 3, or 42 per cent, unimproved; none progressive; none quiescent; 1, or 16 per cent, arrested and none dead. In 16 the temperament was favorable and the finances unfavorable, and of these, 5, or 31 per cent, were improved; 1, or 7 per cent, unimproved; 6, or 37 per cent, progressive; 3, or 18 per cent, quiescent; 1, or 7 per cent, arrested and none dead. Of those with favorable finances and unfavorable temperament, 13 in all, 1, or 8 per cent, was discharged improved; 3, or 23 per cent, unimproved; 3, or 23 per cent, progressive; 2, or 15 per cent, quiescent; 3, or 23 per cent, arrested, and 1, or 8 per cent, dead.

Second Period, 1905 to 1910. This period comprises 302 cases, and of these 59 were under treatment less than a month, or the diagnosis was unconfirmed, or they were classified as arrested on admission. In other words, during this period 18 per cent of all patients admitted should never have entered the sanatorium or been sent away from home. This is a little lower percentage of this type than occurred in the first period in which the figure is 28 per cent. These 59 cases are not included in the analysis of results. In 12 of the 59 cases the diagnosis was uncon-

firmed; 6 died before a month elapsed; 11 were arrested on admission and the remainder were either hopeless cases advised to return home or persons with inadequate finances or impossible temperaments. This leaves 243 cases to be analyzed for results. Deducting 12 cases in which the diagnosis was unconfirmed leaves 290 cases to be analyzed for status on admission.

Two hundred and nineteen are males and 71 females, respectively 75 per cent and 25 per cent. Sixty-one, or 21 per cent, gave a history of exposure in childhood; 74, or 24 per cent, gave a history of delicacy in childhood; 26, or 8 per cent, had both exposure and delicacy, and 172, or 59 per cent, had neither.

Two hundred and two, or 65 per cent, exhibited fever on admission (61 per cent in the first period). The average systolic pressure was 120.7 (119.5 in the first period); 222, or 75 per cent, had elevation of pulse (87 per cent in the first period); 119, or 40 per cent, had anemia (56 per cent in the first period); 119, or 64 per cent, had impaired general condition (83 per cent in the first period); 259, or 87 per cent, had tubercle bacilli in the sputum (92 per cent in the first period). This leaves 13 per cent bacilli-free on admission. Ten, or 3 per cent, had intestinal tuberculosis; 6, or 2 per cent, had genitourinary tuberculosis; 61, or 21 per cent, had laryngeal tuberculosis; 9, or 3 per cent, had fistula-in-ano; 21, or 7 per cent, had hemoptysis under treatment; 13, or 4 per cent, had pleurisy; but 1 had effusion; 4, or 1.3 per cent, had miliary tuberculosis; but one had meningeal tuberculosis; 11 or 3 per cent, had syphilis; 39, or 13 per cent, had some serious nontuberculous complication. There was 1 case of empyema and none of spontaneous pneumothorax; but 2 had otitis media.

One hundred and two, or 46 per cent, were treated with tuberculin (of the 243 cases treated over a month). This period corresponds to the era of tuberculin resuscitation which followed the publication of Trudeau's paper in the *American Journal of the Medical Sciences* in 1907. There were no cases treated with artificial pneumothorax. In this period Bullock began the use of formalin applications twice daily in laryngeal tuberculosis and continued this mode of treatment, with the occasional use of the

cautery and surgical procedure, until the fourth period, when it was abandoned for sunlight exposure.

The average age in the second period was thirty years and eight months, the same as the first period. The average length of stay for those remaining over a month was 9.5 months as compared with 8.8 months in the first period.

There were 57, or 19 per cent, Turban 1 cases; 112, or 40 per cent, Turban 2 cases, and 121, or 41 per cent, Turban 3 cases. Over the first period this shows an increase in the Turban 2 cases at the expense of the other two classes.

There are 243 cases to be analyzed for results in this period: In 90, or 37 per cent, the general condition was still impaired on discharge as compared with 40 per cent in the first period. In 12, or 4 per cent, there was sufficient change in the pulmonary condition to justify a change in the Turban classification from worse to better, and in 12, or 4 per cent, the status was changed from better to worse. Seventy-nine, or 32 per cent, were discharged still febrile as compared with 32 per cent in the first period and 65 per cent on admission. The average systolic pressure on discharge was 124.8 as compared with 120.7 on admission. In 98, or 39 per cent, there was elevation of pulse on discharge as compared with 75 per cent on admission and 45 per cent on discharge in the first period. Twenty-nine, or 11 per cent, had anemia as compared with 38 per cent on admission and 21 per cent on discharge in the first period. (Hypodermic use of citrate of iron began late in this period.) One hundred and sixty-four, or 67 per cent, had tubercle bacilli still present in the sputum on discharge as compared with 87 per cent on admission and 65 per cent on discharge in the first period.

Forty-five, or 18 per cent, of the cases analyzed for results were classified as Turban 1 as compared with 16 per cent in the first period. Of these, 4, or 8 per cent, were discharged improved; 5, or 11 per cent, as unimproved; 1, or 2 per cent, progressive; 9, or 20 per cent, quiescent; 26, or 57 per cent, apparently arrested and none dead.

One hundred and one, or 41 per cent, were classified as Turban

2 as compared with 30 per cent in the first period. Of these, 39, or 38 per cent, were discharged apparently arrested; 17, or 16 per cent, improved; 3, or 3 per cent, unimproved; 16, or 16 per cent, progressive; 22, or 21 per cent, quiescent, and 4, or 3 per cent, dead.

Ninety-seven, or 40 per cent, were classified as Turban 3 as compared with 53 per cent in the first period. Of these, 27, or 7 per cent, were discharged improved; 2, or 2 per cent, as unimproved; 27, or 27 per cent, progressive; 24, or 24 per cent, quiescent; 6, or 6 per cent, apparently arrested, and 11, or 11 per cent, dead.

One hundred and eighty-eight, or 77 per cent, gained weight; 46, or 19 per cent, lost weight, and 9, or 4 per cent, neither gained nor lost.

The present status of the Turban 1 cases in 5 are known to be dead, 26 living and 61 unknown. Of the Turban 2 cases, 15 are dead, 25 living and 61 unknown. Of the Turban 3 cases, 3 are living, 58 dead and 36 unknown.

There were 52 laryngeal cases; healing occurred in 24, or 43 per cent (formalin applications and rest). In 28, or 57 per cent, the larynx was either stationary or progressive. In the first period with no treatment but rest, 50 per cent healed.

Of the 10 cases with intestinal tuberculosis as a complication, 8 were discharged progressive, 1 quiescent and 1 apparently arrested. Of the 5 cases with a complicating genitourinary tuberculosis, 1 died, 2 quiescent, 1 progressive and 1 improved. Of the 7 cases with fistula-in-ano, 3 improved, 3 progressive and 1 quiescent. Hemoptysis occurred in 21, or 7 per cent, and of these, 3 were discharged apparently arrested, 4 improved, 3 quiescent, 8 progressive and 3 died. There were no cases of effusion. Otitis media occurred in but 1 case and was discharged quiescent; miliary tuberculosis in 4 cases and there was 1 case of meningeal tuberculosis. Pleurisy occurred in 11 cases: 2 unimproved, 4 progressive, 1 quiescent, 3 arrested and 1 dead. There were no cases of spontaneous pneumothorax. There was 1 case of empyema discharged quiescent. During the second

period 102 cases were treated with tuberculin. In 28 of those classified as Turban 1, 2, or 7 per cent, were improved; 4, or 14 per cent, unimproved; 6, or 21 per cent, quiescent; 15, or 53 per cent, apparently arrested, none dead, and 1, or 3.5 per cent, progressive. (Observe how closely this corresponds to results in the same class in the first period in which no tuberculin was used.) In those classified as Turban 2, 55 cases, 8, or 14 per cent, were discharged improved; 1, or 6 per cent, as unimproved; 11, or 20 per cent, quiescent; 25, or 46 per cent, apparently arrested; 10, or 18 per cent, progressive, and none died. In those classified as Turban 3 (19 cases), 2, or 11 per cent, were improved; 9, or 50 per cent, quiescent; 2, or 11 per cent, died, and 5, or 23 per cent, progressive, none unimproved, and 1, or 4 per cent, apparently arrested. Without tuberculin there were 17 Turban 1 cases, of which 11, or 64 per cent, were apparently arrested, 2, or 12 per cent, improved; none progressive; 3, or 17 per cent, quiescent; none died; and 1, or 6 per cent, unimproved. There were 46 Turban 2 cases, of which 14, or 30 per cent, were apparently arrested; 9, or 20 per cent, improved; 2, or 4 per cent, unimproved; 12, or 24 per cent, quiescent; 7, or 15 per cent, progressive, and 3, or 7 per cent died. There were 78 Turban 3 cases, of which 5, or 6 per cent, were apparently arrested; 25, or 32 per cent, improved; 2, or 3 per cent, unimproved; 15, or 19 per cent, quiescent; 22, or 28 per cent, progressive, and 9, or 12 per cent, died. In fairness these 9 dead should be mostly eliminated in a comparison between treated and untreated cases, for they were all bad cases in which no one would think of giving tuberculin.

Of 243 cases considered for status on discharge, 30, or 12 per cent, presented a history of exposure in childhood, and of these, 7, or 23 per cent, were discharged improved; 0 per cent unimproved; 4, or 13 per cent, progressive; 8, or 26 per cent, quiescent; 9, or 30 per cent, arrested, and 2, or 7 per cent, dead.

Thirty-nine, or 16 per cent, had delicacy in childhood, and of these, 10, or 25 per cent, were discharged improved; 4, or 10 per cent, unimproved; 5, or 13 per cent, progressive; 8, or 20 per cent, quiescent; 10, or 25 per cent, arrested; 2, or 4 per cent, dead.

One hundred and fifty-five, or 63 per cent, had neither delicacy nor exposure. Of these, 26, or 16 per cent, were discharged improved; 5, or 4 per cent, unimproved; 32, or 20 per cent, progressive; 35, or 22 per cent, quiescent; 49, or 31 per cent, arrested, and 8, or 6 per cent, dead.

Nineteen, or 7 per cent, had both exposure and delicacy. Of these, 5, or 26 per cent, were improved; 1 or 5 per cent, unimproved; 4, or 20 per cent, progressive; 4, or 20 per cent, quiescent; 3, or 15 per cent, arrested, and 2, or 10 per cent, dead.

One hundred and twenty-three, or 50 per cent, presented both favorable temperament and financial condition. Of these, 10, or 8 per cent, were discharged improved; 2, or 4 per cent, unimproved; 30, or 24 per cent, progressive; 18, or 14 per cent, quiescent; 52, or 42 per cent, arrested, and 11, or 8 per cent, dead.

Ten, or 4 per cent, presented both unfavorable temperament and finances. Of these, 3, or 30 per cent, were discharged improved; 2, or 20 per cent, unimproved; 1, or 10 per cent, progressive; 2, or 20 per cent, quiescent; 2, or 20 per cent, arrested, and 6 per cent dead.

Fifty-six, or 23 per cent, presented a favorable temperament but unfavorable finances. Of these, 18, or 32 per cent, were discharged improved; none unimproved; 8, or 14 per cent, progressive; 22, or 39 per cent, quiescent; 6, or 10 per cent, arrested, and 2, or 3 per cent, dead.

Fifty-four, or 23 per cent, present an unfavorable temperament with favorable finances. Of these, 17, or 31 per cent, were discharged improved; 6, or 11 per cent, unimproved; 6, or 11 per cent, progressive; 13, or 24 per cent, quiescent; 11, or 20 per cent, arrested, and 1, or 2 per cent dead.

Third Period, 1910 to 1915. This period comprises 467 cases, of which 107 were under treatment less than a month or the diagnosis was unconfirmed or classified as arrested on admission. In other words, 22 per cent of the cases admitted should never have entered the sanatorium or been sent away from home. These 107 cases are not included in the analysis of results. In 12 of the 107 the diagnosis was unconfirmed, 14 died before a

month elapsed and 26 were arrested on admission. The remainder were either hopeless types advised to return home or persons with impossible temperaments or inadequate finances. This leaves 360 cases to be analyzed for results, though a further reduction is made by taking out 35 cases, treated by means of artificial pneumothorax (all cases in which it was tried or successful), for it is not considered that these cases, which are in a class by themselves, should be included in an attempt to evaluate climate in tuberculosis. This leaves 325 cases to be analyzed for results. This period is of special interest, for it not only marked the beginning of artificial pneumothorax, but, as well, was an epoch in the work when Bullock applied tuberculin very generally in an attempt to discover its actions and uses.

In considering status on admission there are 467 cases minus the 12 in which the diagnosis was unconfirmed, leaving 455. Of these, 326 are males and 129 are females, respectively 44 per cent and 36 per cent.

One hundred and twelve, or 24 per cent, gave a history of exposure in childhood; 82, or 17 per cent, presented a history of delicacy in childhood, and 26, or 5 per cent, had a history of both exposure and delicacy; 261, or 57 per cent, had neither, about the same percentages as in the first and second periods.

Three hundred and nine, or 65 per cent, had fever on admission (61 per cent in the first period and 65 per cent in the second period). The average systolic pressure was 123.4 (119.5 in the first and 120.7 in the second period). Three hundred and thirty-two, or 72 per cent, had elevation of pulse (87 per cent in the first period and 75 per cent in the second period); 102, or 21 per cent, had anemia (56 per cent in the first period and 40 per cent in the second period); 279, or 61 per cent, had impaired general condition (83 per cent in the first period and 64 per cent in the second period); 407, or 89 per cent, had tubercle bacilli in the sputum (92 per cent in the first period and 87 per cent in the second period); 48, or 10 per cent, were bacilli-free on admission; 14, or 3 per cent, had intestinal tuberculosis; 6, or 1 per cent, had genitourinary tuberculosis; 90, or 19 per cent, had laryngeal

tuberculosis; 8, or 1 per cent, had fistula-in-ano; 44, or 9 per cent, had hemoptysis under treatment; 22, or 4 per cent, had pleurisy under treatment; 14, or 3 per cent, had effusion; 6, or 1 per cent, had otitis media; 1 case of miliary tuberculosis, or one-eighth of 1 per cent; 2 of meningeal, or one-fourth of 17; 23, or 4 per cent, had syphilis; 41, or 9 per cent, had some serious non-tuberculous complications; 10, or 2 per cent, had spontaneous pneumothorax. There was but 1 case of empyema.

Two hundred and twenty-four, or 49 per cent, were treated with tuberculin. The average age in the third period was thirty years and eight months (the same for all three periods). The average period of treatment for those remaining over a month was ten and one-half months as compared with 8.8 months in the first period and 9.5 in the second.

There were 70, or 15 per cent, Turban 1 cases; 185, or 40 per cent, Turban 2 cases; 200, or 45 per cent, Turban 3 cases. These percentages are practically the same as in the second period but show some improvement in favorable types over the first.

In the third period there are 325 cases to be analyzed for results. In 104, or 32 per cent, the general condition was still impaired on discharge (44 per cent in the first and 37 per cent in the second). In 37, or 10 per cent, there was sufficient change in pulmonary status to justify an alteration in the Turban classification from worse to better, and in 13, or 4 per cent, from better to worse. One hundred and nine, or 33 per cent, were discharged febrile as compared with 32 per cent in the first and second periods and 65 per cent on admission in all three periods. The percentage losing fever was constant for the three periods. The average systolic pressure on discharge was 124 as compared with 123.4 on admission. In 113, or 32 per cent, there was an elevation of pulse on discharge as compared with 72 per cent on admission and 45 per cent on discharge in the first period and 39 per cent in the second period. Eleven, or 3 per cent, had anemia on discharge as compared with 21 per cent on admission and 21 per cent on discharge in the first period and 11 per cent in the second period. The practically normal hemoglobin in this period is

explained by the hypodermic use of citrate of iron. Two hundred and twenty-two, or 69 per cent, had tubercle bacilli on discharge as compared with 65 per cent in the first and 67 per cent in the second period and 89 per cent on admission in this period. In other words, as regards the percentage losing tubercle bacilli in all three periods the results are practically constant. The free use of tuberculin in the third period certainly did not increase the percentage discharged bacilli-free.

In 259, or 78 per cent, the temperament favored a good result, and in 66, or 22 per cent, the temperament was opposed to a good result. In 130, or 55 per cent, the financial condition favored a good result and in 145, or 45 per cent, the financial condition was opposed to a good result. In 170, or 52 per cent, both temperament and financial condition favored a good result, and in 11, or 3 per cent, both temperament and financial condition were opposed to a good result.

Forty-eight, or 15 per cent, were classified as Turban 1, about the same as in the first and second periods. Of these, 1, or 2 per cent, was discharged improved; 2, or 4 per cent, unimproved; 3, or 5 per cent, progressive; 5, or 10 per cent, quiescent; 37, or 77 per cent, apparently arrested, and none dead. Comparison of the Turban 1 cases of the third period with those of the first and second shows a distinct gain in the percentage of apparently arrested.

One hundred and forty, or 43 per cent, were classified as Turban 2. Of these, 10, or 7 per cent, were improved; 4, or 2 per cent, unimproved; 23, or 16 per cent, progressive; 42, or 29 per cent, quiescent; 55, or 40 per cent, apparently arrested and 6, or 4 per cent, dead.

One hundred and thirty-seven, or 42 per cent, were classified as Turban 3. Of these, 28, or 20 per cent, were discharged improved; 8, or 5 per cent, unimproved; 43, or 31 per cent, progressive; 31, or 23 per cent, quiescent; 10, or 7 per cent, apparently arrested, and 17, or 12 per cent, dead.

In the third period 224, or 68 per cent, gained weight; 68, or 21 per cent, lost weight, and 33, or 11 per cent, neither gained

nor lost. The present status of the Turban 1 cases is, 16 are living, 3 are dead and 19 are unknown. Of the Turban 2 cases, 34 are living, 23 are dead and 83 are unknown. Of the Turban 3 cases, 6 are living, 39 are dead and 92 are unknown.

Of the 12 cases with intestinal tuberculosis treated over a month, none were discharged improved, 1 unimproved, 4 progressive, 3 quiescent, 1 apparently arrested and 3 dead. Of the 4 cases with genitourinary tuberculosis, 1 quiescent, 1 apparently arrested and 2 died. Of the laryngeal cases in 33 the larynx healed and in 34 it was progressive or stationary. (Regardless of the mode of treatment observe how much alike the results of treatment in this complication are.) Fifty-six per cent healed in the first period, 46 per cent in the second and 49 per cent in the third. Of the 17 cases with fistula-in-ano, 12 were progressive, 3 quiescent, 1 apparently arrested and 1 died. Of the 24 cases having hemoptysis under treatment, 2 were improved, 3 unimproved, 4 progressive and 15 died. Of the cases developing effusion, 3 were progressive, 3 quiescent, 3 apparently arrested and 3 died. Of the 6 cases with otitis media, 2 were improved, 2 unimproved, 1 progressive and 1 quiescent. Of the 14 cases having pleurisy, 2 unimproved, 2 progressive, 4 quiescent, 3 arrested and 2 dead. There was but 1 case of miliary tuberculosis and 3 of meningeal tuberculosis. There were 8 cases of spontaneous pneumothorax: 5 discharged progressive, 1 improved and 1 quiescent. There were no cases of empyema.

In the third period there were 35 cases treated by means of artificial pneumothorax—that is, both attempted and successful. One was a Turban 1 case with the following result: 1, or 100 per cent, improved with adequate compression. There were 13 Turban 2 cases; in 3 compression was impossible, and deducting these gives the following result: Apparently arrested 2, or 20 per cent; quiescent 3, or 30 per cent; improved none; progressive 3, or 30 per cent; died 1, or 10 per cent; unimproved 1, or 10 per cent. There were 21 Turban 3 cases, and deducting 5 in which compression was impossible and 1 in which it was relative gives the following result: Apparently arrested 7, or 45 per cent;

improved 1, or 7 per cent; unimproved 1, or 7 per cent; progressive 2, or 14 per cent; died 4, or 28 per cent. Four of those with a successful compression are known to be living, 3 are dead and the others are unknown.

Sixty-six, or 20 per cent, of the 325 cases considered for status on discharge presented a history of exposure in childhood, and of these, 8, or 13 per cent, were discharged improved; 8, or 13 per cent, unimproved; 13, or 19 per cent, progressive; 17, or 27 per cent, quiescent; 15, or 23 per cent, arrested, and 5, or 5 per cent, dead.

Thirty-six, or 11 per cent, had a history of delicacy in childhood, and of these, 4, or 11 per cent, were discharged improved; 1, or 3 per cent, unimproved; 8, or 22 per cent, progressive; 12, or 33 per cent, quiescent; 10, or 27 per cent, arrested, and 1, or 3 per cent, dead.

Two hundred and eight, or 64 per cent, had neither exposure nor delicacy, and of these, 24, or 11 per cent, were discharged improved; 5, or 5 per cent, unimproved; 45, or 21 per cent, progressive; 44, or 21 per cent, quiescent; 74, or 35 per cent, arrested, and 16, or 7 per cent, dead.

Fifteen, or 4 per cent, had both exposure and delicacy, and of these, 2, or 13 per cent, were discharged improved; none unimproved; 3, or 20 per cent, progressive; 5, or 33 per cent, quiescent; 4, or 26 per cent, arrested, and 1, or 6 per cent, dead.

Of the 325 cases considered for status on discharge, 196 were treated with tuberculin, and of these, 39, or 18 per cent, were classified as Turban 1 with the following results: 1, or 3 per cent, was discharged improved; 2, or 6 per cent, unimproved; 2, or 6 per cent, progressive; 4, or 11 per cent, quiescent; 30, or 72 per cent, apparently arrested, and 0 per cent dead.

One hundred and two, or 52 per cent, were classified as Turban 2. Four, or 4 per cent, were improved; 2, or 2 per cent, unimproved; 16, or 15 per cent, progressive; 32, or 31 per cent, quiescent; 46, or 45 per cent, apparently arrested, and 2, or 2 per cent, dead.

Fifty-five, or 30 per cent, were classified as Turban 3. Eight, or 14 per cent, were improved; 4, or 7 per cent, unimproved; 16,

or 29 per cent, progressive; 18, or 32 per cent, quiescent; 6, or 12 per cent, apparently arrested, and 3, or 5 per cent, dead.

Of those not treated with tuberculin, 129 cases, the results were as follows: 9, or 8 per cent, were classified as Turban 1; none were improved; none were unimproved; 1, or 11 per cent, was progressive; 1, or 11 per cent, quiescent; 7, or 77 per cent, apparently arrested, and none died.

There were 38, or 29 per cent, Turban 2 cases; 6, or 14 per cent, were discharged improved; 2, or 5 per cent, unimproved; 7, or 18 per cent, progressive; 10, or 26 per cent, quiescent; 9, or 23 per cent, apparently arrested, and 4, or 10 per cent, died.

There were 82, or 63 per cent, Turban 3 cases: 20, or 24 per cent, were improved; 3, or 4 per cent, unimproved; 27, or 32 per cent, progressive; 14, or 17 per cent, quiescent; 4, or 6 per cent, apparently arrested, and 14, or 17 per cent, died.

Of the 325 cases considered for status on discharge, 170, or 52 per cent, presented both favorable temperament and financial condition, and of these, 10, or 5 per cent, were discharged improved; 1, or 1 per cent, unimproved; 40, or 23 per cent, progressive; 26, or 15 per cent, quiescent; 73, or 42 per cent, apparently arrested, and 20, or 11 per cent, dead.

Eighty-nine, or 27 per cent, presented a favorable temperament with unfavorable finances, and of these, 17, or 19 per cent, were discharged improved; 5, or 6 per cent, unimproved; 13, or 15 per cent, progressive; 37, or 41 per cent, quiescent; 16, or 17 per cent, arrested; and 1, or 1 per cent, dead.

Fifty-four, or 16 per cent, presented favorable finances with unfavorable temperament, and of these, 11, or 20 per cent, were discharged improved; 4, or 8 per cent, unimproved; 13, or 24 per cent, progressive; 11, or 20 per cent, quiescent; 13, or 24 per cent, arrested, and 2, or 4 per cent, dead.

Twelve, or 5 per cent, had both unfavorable temperament and financial condition, and of these, 1, or 8 per cent, was discharged improved; 3, or 25 per cent, unimproved; 3, or 25 per cent, progressive; 5, or 41 per cent, quiescent, none arrested and none dead.

Fourth Period, 1915 to 1920. Before taking the statistics from this period it should be observed that Dr. Bullock was away in the War during almost two years of this time, and, therefore, as the institution was left in inexperienced hands, we are inclined to anticipate that there will be a falling off in the average length of stay and consequently in the results. It should also be noted that during this period tuberculin was reserved more and more for those patients who seemed to get better up to a certain point and then stop. In this period also we began the treatment of laryngeal tuberculosis exclusively by means of rest and sunlight exposure.

This period comprises 569 cases. Of these 569 cases, 209 were under treatment less than a month, or the diagnosis was unconfirmed or classified as arrested on admission. In other words, 34 per cent of all cases admitted should never have entered the sanatorium or been sent away from home. This is the largest percentage of this class so far. These 209 cases are not included in the analysis of results. There are also 38 cases of artificial pneumothorax which will be analyzed separately and not included in the analysis of results. This leaves 322 cases to be analyzed for results, practically the same number as in the previous period. Twenty-six of the 209 excluded cases died in less than a month; in 35 the diagnosis was unconfirmed; in 37 the condition was arrested on admission. The remaining 111 cases were either hopeless types advised to return home or persons with inadequate finances or impossible temperaments.

In considering status on admission, there are 569 cases minus the 35 in which the diagnosis was unconfirmed, leaving 534 cases to be analyzed. Of these 360 are males and 174 females, respectively 69 per cent and 31 per cent, practically the same as in the previous periods. One hundred and fifty, or 34 per cent, gave a history of exposure in childhood; 124, or 20 per cent, gave a history of delicacy in childhood; 41, or 7 per cent, had a history of both exposure and delicacy; and 313, or 58 per cent, had neither, which is about the same percentages as in previous periods.

Three hundred and thirty-nine, or 63 per cent, presented fever

on admission, just about the same as in previous periods. The average systolic pressure was 118 (first period 119.5, second 120.7, third 123.4). Three hundred and seventy, or 69 per cent, presented elevation of pulse (first period 87 per cent, second period 75 per cent and third period 72 per cent). Two hundred and forty five, or 46 per cent, had anemia on admission (first period 56 per cent, second period 38 per cent and third period 21 per cent). Four hundred and seven, or 76 per cent, had impaired general condition (first period 83 per cent, second period 64 per cent and third period 61 per cent). Four hundred and sixty-four, or 86 per cent, had tubercle bacilli in the sputum (first period 92 per cent, second period 87 per cent and third period 89 per cent). Seventy, or 11 per cent, were bacilli-free on admission.

Fourteen, or 2 per cent, had intestinal tuberculosis; 11, or 1.5 per cent, had genitourinary tuberculosis; 61, or 11 per cent, had laryngeal tuberculosis; 5, or 0.6 per cent, had fistula-in-ano; 21, or 3 per cent, had hemoptysis under treatment; 14, or 2 per cent, had pleurisy; 14, or 2 per cent, had effusion; 5, or 0.6 per cent, had otitis media. There were 2 cases of miliary tuberculosis; 5, or 0.6 per cent, had meningeal tuberculosis; 18, or 3 per cent, had syphilis; 43, or 8 per cent, had some serious nontuberculous complication; 9, or 1.3 per cent, developed spontaneous pneumothorax; 5, or 0.7 per cent, had empyema. Fifty-four, or 9 per cent, were treated with tuberculin.

The average age in the fourth period was thirty-one years and seven months, a little older than the previous periods, due to the admission of three or four very old people. The average length of treatment for those remaining over a month was 7.9 months, which is the shortest period of all, and what we anticipated from Dr. Bullock's absence before we started to write this section.

There were 90, or 17 per cent, Turban 1 cases; 156, or 29 per cent, Turban 2 cases, and 288, or 53 per cent, Turban 3 cases, showing a loss of favorable types to a small degree.

In the fourth period there are 322 cases to be analyzed for results. In 103, or 32 per cent, the general condition was still

impaired on discharge, which is the same as in the third period. It was 44 per cent in the first period and 35 per cent in the second. In 32, or 10 per cent, there was sufficient change in the pulmonary condition to justify an alteration of the Turban classification from worse to better and in 10, or 3 per cent, from better to worse. This is about the same as in the third period, but registers a larger percentage of changes than in the first and second periods. It is very exceptional for a patient to be under observation long enough to show much change in the Turban classification. Eighty-four, or 26 per cent, were discharged febrile as compared with 32 per cent in the first and second periods, 33 per cent in the third and 63 per cent on admission, and 65 per cent on admission in the other three periods. The average systolic pressure was 120.4 as compared with 118 on admission. In 90, or 28 per cent, there was elevation of pulse on discharge as compared with 69 per cent on admission (45 per cent on discharge in the first period, 39 per cent in the second and 32 per cent in the third). Twenty-eight, or 8 per cent, had anemia on discharge as compared with 46 per cent on admission (21 per cent on discharge in the first period, 11 per cent in the second and 3 per cent in the third).

In 211, or 65 per cent, tubercle bacilli were present on discharge as compared with 86 per cent on admission (65 per cent in the first on discharge, 66 per cent in the second and 69 per cent in the third). The percentage losing tubercle bacilli is very constant.

Fifty-one, or 15 per cent, were classified as Turban 1. (This percentage is constant for all periods.) Of these, 3, or 5 per cent, were improved; 5, or 9 per cent, unimproved; 2, or 3 per cent, progressive; 10, or 19 per cent, quiescent; 31, or 60 per cent, apparently arrested, and none dead.

One hundred and nineteen, or 36 per cent, were classified as Turban 2. Of these, 4, or 4 per cent, were improved; 6, or 6 per cent, unimproved; 7, or 7 per cent, progressive; 48, or 40 per cent, quiescent; 53, or 42 per cent, apparently arrested, and 1, or 0.6 per cent, dead.

One hundred and fifty-two, or 47 per cent, were classified as Turban 3. Of these, 19, or 12 per cent, were discharged improved;

7, or 6 per cent, unimproved; 42, or 28 per cent, progressive; 47, or 30 per cent, quiescent; 17, or 11 per cent, apparently arrested, and 20, or 13 per cent, dead.

In the fourth period, 218, or 67 per cent, gained weight (the same percentage for all periods); 61, or 18 per cent, lost weight, and 43, or 10 per cent, neither gained nor lost.

The present status of the Turban 1 cases is: 28 are living, 1 is dead and 21 are unknown. Of the Turban 2 cases, 51 are living, 7 are dead and 61 are unknown. Of the Turban 3 cases, 25 are living, 47 are dead and 80 are unknown. Of the 14 cases with intestinal tuberculosis, 1 was discharged unimproved, 8 progressive, 1 quiescent, 1 apparently arrested and 3 died. Of the 9 cases with genitourinary tuberculosis, 4 were unimproved, 3 progressive, 1 apparently arrested and 1 died. In the cases with laryngeal tuberculosis, 20, or 58 per cent, healed, and in 14, or 42 per cent, the lesion was stationary or progressive. For the first time we see an improvement in laryngeal results, and this may be due to sunlight treatment. Of the 5 cases with fistula-in-ano, 1 was improved, 1 progressive, 2 quiescent, and 1 apparently arrested. In the 19 cases with hemoptysis under treatment, 1 was improved, 8 quiescent, 5 apparently arrested and 5 died as a direct result of the hemorrhage. Of the cases with simple effusion, 2 were improved, 2 unimproved, 4 progressive, 2 quiescent and 5 apparently arrested. Of the cases with otitis media, 2 were improved, 2 quiescent and 2 died. Of the 11 cases with pleurisy, 2 improved, 2 unimproved, 1 progressive, 2 quiescent, 4 arrested and none died. The percentages having meningeal tuberculosis, miliary tuberculosis and spontaneous pneumothorax are the same as in the previous period.

In the fourth period there were 38 cases treated with artificial pneumothorax. In 1 Turban 1 case the compression was adequate and the result quiescent. There were 5 Turban 2 cases. The degree of compression was adequate in 3, and in 2 of which the status on discharge was progressive; in 1 quiescent; in 2 cases the compression was relative and the result death. There were 33 Turban 3 cases in which compression was either attempted or

used. In 20 the compression was adequate with the following results: 1 improved, 1 unimproved, 4 progressive, 4 quiescent, 6 apparently arrested and 4 dead. In 5 the compression was relative with the following results: In 3 progressive, 1 apparently arrested and 1 died. In 8 cases compression was impossible, that is in 20 per cent. Of these compression cases 18 are known to be living, 16 dead and 5 unknown.

When compression succeeds the results are so dramatic that it overshadows the failures in one's mind and memory, but in judging this procedure it should be recalled that it is reserved for bad and progressive cases only, and on account of its unfortunate by-products can wisely be employed only in such.

There were 67 cases, or 23 per cent, in which there was a history of exposure in childhood, and of these, 3, or 4 per cent, were improved; 7, or 8 per cent, unimproved; 6, or 9 per cent, progressive; 25, or 38 per cent, quiescent; 18, or 23 per cent, arrested and 8, or 11 per cent, dead.

There were 40 cases, or 14 per cent, with a history of delicacy in childhood, and of these, 4, or 10 per cent, were improved; 4, or 10 per cent, unimproved; 9, or 23 per cent, progressive; 11, or 27 per cent, quiescent; 10, or 25 per cent, arrested, and 2, or 5 per cent, dead.

There were 189 cases, or 59 per cent, in which there was neither exposure nor delicacy, and of these, 19, or 10 per cent, were improved; 7, or 3 per cent, unimproved; 33, or 17 per cent, progressive; 55, or 29 per cent, quiescent; 64, or 33 per cent, arrested and 11, or 5 per cent, dead.

There were 26 cases, or 8 per cent, with a history of both exposure and delicacy in childhood, and of these, 0 per cent were improved; 0 per cent unimproved; 3, or 11 per cent, progressive; 13, or 50 per cent, quiescent; 9, or 34 per cent, arrested, and 1, or 4 per cent, dead.

There were 149, or 46 per cent, cases in which both temperament and finances were favorable, and of these, 4, or 3 per cent, were improved; 3, or 2 per cent, unimproved; 23, or 16 per

cent, progressive; 35, or 23 per cent, quiescent; 66, or 44 per cent, arrested, and 18, or 12 per cent, dead.

There were 88 cases, or 27 per cent, in which the temperament was favorable and the finances unfavorable, and of these, 12, or 12 per cent, were improved; 5, or 7 per cent, unimproved; 12, or 12 per cent, progressive; 35, or 40 per cent, quiescent; 22, or 25 per cent, arrested, and 2, or 4 per cent, dead.

The 66 cases of 20 per cent in which the temperament was unfavorable and the finances favorable, 7, or 10 per cent, were improved; 5, or 7 per cent, unimproved; 15, or 22 per cent, progressive; 27, or 40 per cent, quiescent; 11, or 16 per cent, arrested and 1, or 2 per cent, dead.

There were 19 cases, or 5 per cent, in which both temperament and finances were unfavorable, and of these, 2, or 10 per cent, were improved; 7, or 36 per cent, unimproved; 1, or 5 per cent, progressive; 7, or 36 per cent, quiescent; 2, or 10 per cent, arrested and 0 per cent, dead.

There were 45 cases, or 14 per cent, treated with tuberculin; 13, or 28 per cent, were classified as Turban 1, and of these, 1, or 7 per cent, was improved; 1, or 7 per cent, unimproved; 1, or 7 per cent, progressive; 3, or 23 per cent, quiescent; 7, or 54 per cent, arrested, and 0 per cent, dead.

Twenty-eight, or 62 per cent, were classified as Turban 2, and of these none were improved; 2, or 7.5 per cent, unimproved; 2, or 7.5 per cent, progressive; 10, or 35 per cent, quiescent; 14, or 50 per cent, arrested, and 0 per cent dead.

Four, or 8 per cent, were classified as Turban 3, and of these, 0 per cent were improved, 0 per cent unimproved, 0 per cent progressive; 2, or 50 per cent, quiescent; 1, or 25 per cent, arrested, and 1, or 25 per cent, dead.

There were 277 cases, or 86 per cent, treated without tuberculin and 36, or 12 per cent, were classified as Turban 1, and of these, 2, or 5 per cent, were improved; 2, or 5 per cent, unimproved; 1, or 2.5 per cent, progressive; 8, or 22 per cent, quiescent; 23, or 63 per cent, arrested, and 0 per cent dead.

There were 91 cases, or 32 per cent, classified as Turban 2,

and of these, 4, or 4 per cent, were improved; 5, or 6 per cent, unimproved; 5, or 6 per cent, progressive; 35, or 37 per cent, quiescent; 40, or 44 per cent, arrested; 2, or 2 per cent, dead.

There were 150 cases, or 53 per cent, classified as Turban 3, and of these, 19, or 12 per cent, were improved; 7, or 4 per cent, unimproved; 41, or 27 per cent, progressive; 49, or 32 per cent, quiescent; 17, or 11 per cent, arrested, and 17, or 11 per cent, dead.

All Periods, 1900 to 1920. Our twenty years' work comprises 1454 finished cases, of which 408 were under treatment less than one month or the diagnosis was unconfirmed or classified as arrested on admission. In other words, 24 per cent of all cases admitted from 1900 to 1920 should never have entered the institution or been sent away from home. These 408 cases are not included in the analysis of results. There were 73 cases treated by artificial pneumothorax, which are analyzed separately and not included in the analysis of results. This leaves 973 cases to be analyzed for results. In 63 cases the diagnosis was not confirmed; 76 were arrested on admission. The remaining 296 cases were hopeless types advised to return home or persons with inadequate finances or impossible temperaments.

For consideration of status on admission there are 1391 cases; those with unconfirmed diagnosis have been excluded from the total number. Of these 995 are males and 396 are females; respectively, 79 per cent and 21 per cent.

In 361, or 25 per cent, there was a history of exposure in childhood; in 309, or 22 per cent, there was a history of delicacy in childhood; 108, or 7 per cent, had both and 806, or 57 per cent, had neither.

One thousand and nine, or 72 per cent, presented fever on admission. The average systolic pressure was 120.4, which is normal for young adults; 1021, or 73 per cent, presented elevation of pulse on admission; 529, or 38 per cent, had anemia; 979, or 70 per cent, had impaired general condition; 1234, or 87 per cent, had tubercle bacilli in the sputum on admission; 157, or 13 per cent, were bacilli-free on admission; 26, or 2 per cent, had genito-

urinary tuberculosis as a complication. Forty-six, or 3 per cent, had intestinal tuberculosis; 232, or 16 per cent, had laryngeal tuberculosis; 29, or about 1 per cent, had fistula-in-ano; hemoptysis under treatment occurred in 100, or 11 per cent; effusion occurred in 31, or 3 per cent. (The use of compression has increased the percentage having effusion.) Pleurisy occurred in 66, or 6 per cent; otitis media in 16, or 1 per cent; miliary tuberculosis in 9, or —1 per cent; meningeal tuberculosis in 8, or —1 per cent; syphilis in 56, or 4 per cent, which corresponds with the percentage in the general run of the population; spontaneous pneumothorax occurred in 20, or 2 per cent. This had also been increased by the use of compression. Some serious nontuberculous complication was found in 140, or 9 per cent. Empyema occurred in 9, or —1 per cent. Tuberculin was administered to 380, or 27 per cent. The average age for all periods was thirty-one years. The average length of treatment was 9.1 months.

There were 243, or 16 per cent, Turban 1 cases; 482, or 35 per cent, Turban 2 cases, and 676, or 48 per cent, Turban 3 cases.

There are 973 cases to be analyzed for results. The general condition was still impaired in 334, or 34 per cent, as compared with 70 per cent on admission (44 per cent on discharge in the first period, 35 per cent in the second period and 32 per cent in the third and fourth periods). In 83, or 8 per cent, there was sufficient change in the pulmonary status to justify an alteration in the Turban classification from worse to better and in 35, or 3 per cent, from better to worse. Two hundred and eighty-nine, or 30 per cent, were discharged febrile as compared with 66 per cent on admission (32 per cent in the first and second periods, 33 per cent in the third period and 26 per cent in the fourth period). The average systolic pressure on discharge was 122.5 as compared with 120.4 on admission. In 339, or 34 per cent, the pulse was still elevated on discharge as compared with 73 per cent on admission (45 per cent on discharge in the first period, 39 per cent in the second period, 32 per cent in the third period and 28 per cent in the fourth period). In 86, or 8 per cent, there was anemia on discharge as compared with 38 per

cent on admission (21 per cent on discharge in the first period, 11 per cent in the second period, 2 per cent in the third period and 8 per cent in the fourth period). In 651, or 67 per cent, tubercle bacilli were still present in the sputum as compared with 87 per cent on admission (65 per cent on discharge in the first period, 66 per cent in the second period, 69 per cent in the third period and 66 per cent in the fourth period).

There were 158, or 15 per cent, Turban 1 cases. Of these, 12, or 7 per cent, were discharged improved; 13, or 8 per cent, unimproved; 7, or 3 per cent, progressive; 24, or 16 per cent, quiescent; 102, or 64 per cent, apparently arrested, and none dead.

There were 385 Turban 2 cases, and of these, 33, or 9 per cent, were discharged improved; 15, or 3 per cent, unimproved; 48, or 12 per cent, progressive; 115, or 30 per cent, quiescent; 163, or 42 per cent, apparently arrested, and 11, or 2 per cent, dead.

There were 430 Turban 3 cases, and of these, 81, or 18 per cent, were discharged improved; 23, or 5 per cent, unimproved; 127, or 29 per cent, progressive; 114, or 26 per cent, quiescent; 34, or 7 per cent, apparently arrested, and 51, or 11 per cent, died.

Of the cases which have just been analyzed in the Turban 1 class, 76 are known to be living, 73 are unknown and 9 are dead. Of the Turban 2 class, 117 are living, 220 are unknown and 48 are dead. Of the Turban 3 class, 35 are living, 228 are unknown and 167 are dead.

There are 171 cases of laryngeal tuberculosis. In 86, or 50 per cent, this lesion healed; in 85, or 50 per cent, it failed to heal or was progressive. There were 42 cases of intestinal tuberculosis. None were discharged improved; 2, or 5 per cent, unimproved; 23, or 54 per cent, progressive; 6, or 13 per cent, quiescent; 3, or 7 per cent, apparently arrested, and 8, or 18 per cent, dead. There were 21 cases of genitourinary tuberculosis. Of these, 2, or 9 per cent, were improved; 4, or 19 per cent, were unimproved; 6, or 28 per cent, were progressive; 3, or 14 per cent, quiescent; 2, or 9 per cent, apparently arrested, and 4, or 19 per cent, died. There were 35 cases with fistula-in-ano. Of these, 6, or 17 per cent, were improved; 1, or 3 per cent,

unimproved; 18, or 50 per cent, progressive; 7, or 20 per cent, quiescent; 2, or 5 per cent, apparently arrested; 1, or 3 per cent, died. In 73 there was hemoptysis during treatment. Of these, 8, or 12 per cent, were improved; 4, or 6 per cent, were unimproved; 14, or 18 per cent, progressive; 13, or 17 per cent, quiescent; 11, or 13 per cent, apparently arrested, and 23, or 32 per cent, died. There were 16 cases of otitis media. Of these 6, or 37 per cent, were improved; 3, or 19 per cent, unimproved; 2, or 12 per cent, progressive; 3, or 19 per cent, quiescent; none apparently arrested; 2, or 12 per cent, died.

Six hundred and eighty-five, or 69 per cent, gained weight; 192, or 19 per cent, lost weight and 96, or 12 per cent, neither gained nor lost.

In all there were 73 cases in which artificial pneumothorax was successful, relative and impossible. There were 2 Turban 1 cases done at their own request before we had learned the limitations of this method. All were successfully compressed and the results were as follows: Improved 50 per cent, unimproved 0 per cent, progressive 0 per cent, quiescent 50 per cent, arrested 0 per cent, dead 0 per cent.

There were 15 cases of Turban 2, all progressive in character, in which compression was adequate or relative, with the following results: Improved, 0 per cent; unimproved, 0 per cent; progressive in 5, or 33 per cent; quiescent in 4, or 25 per cent; apparently arrested in 2, or 13 per cent; dead 3, or 20 per cent.

There were 41 Turban 3 cases, all progressive in type, in which compression was complete or relative with the following results: Improved 4 per cent, unimproved 4 per cent, progressive 25 per cent, quiescent 9 per cent, apparently arrested 34 per cent, died 21 per cent. This leaves 15, or 20 per cent, in which compression was impossible.

Of the 973 cases to be considered for status on discharge, 183, or 18 per cent, gave a history of exposure in childhood, and of these, 21, or 11 per cent, were discharged improved; 17, or 9 per cent, unimproved; 26, or 14 per cent, progressive; 55, or 30 per cent, quiescent; 49, or 26 per cent, arrested, and 15, or 8 per cent, dead.

One hundred and twenty-six, or 12 per cent, gave a history of delicacy in childhood, and of these, 18, or 14 per cent, were improved; 13, or 9 per cent, unimproved; 24, or 19 per cent, progressive; 33, or 26 per cent, quiescent; 32, or 26 per cent, arrested and 6, or 4 per cent, dead.

In 594, or 61 per cent, there was a history of neither exposure nor delicacy, and of these 77, or 12 per cent, were improved; 20, or 3 per cent, unimproved; 120, or 20 per cent, progressive; 140, or 23 per cent, quiescent; 200, or 35 per cent, arrested, and 37, or 6 per cent, dead.

In 70, or 7 per cent, there was a history of both delicacy and exposure, and of these 11, or 15 per cent, were improved; 1, or 1 per cent, unimproved; 12, or 16 per cent, progressive; 25, or 35 per cent, quiescent; 19, or 27 per cent, arrested, and 4, or 5 per cent, dead.

Of 973 cases, 489, or 50 per cent, presented both favorable temperament and finances, and of these, 27, or 5 per cent, were discharged improved; 9, or 2 per cent, unimproved; 101, or 20 per cent, progressive; 88, or 17 per cent, quiescent, 212, or 43 per cent, arrested, and 52, or 10 per cent, dead.

Both temperament and financial condition were unfavorable in 48, or 4 per cent, and of these, 9, or 18 per cent, were improved; 15, or 31 per cent, unimproved; 5, or 10 per cent, progressive; 14, or 29 per cent, quiescent; 5, or 10 per cent, arrested, and none dead.

In 249, or 25 per cent, the temperament was favorable and the finances unfavorable, and of these 51, or 20 per cent, were improved; 11, or 4 per cent, unimproved; 38, or 15 per cent, progressive; 97, or 38 per cent, quiescent; 45, or 18 per cent, arrested, and 5, or 2 per cent, dead.

In 187, or 19 per cent, the finances were favorable and the temperament unfavorable, and of these 36, or 19 per cent, were improved; 18, or 9 per cent, unimproved; 37, or 20 per cent, progressive; 53, or 28 per cent, quiescent; 38, or 21 per cent, arrested, and 5, or 2 per cent, dead.

There were 343 cases, or 36 per cent, treated with tuberculin;

80, or 23 per cent, were classified as Turban 1, and of these 4, or 5 per cent, were improved; 7, or 8 per cent, unimproved; 4, or 5 per cent, progressive; 13, or 16 per cent, quiescent; 52, or 65 per cent, arrested, and 0 per cent dead.

One hundred and eighty-five, or 54 per cent, were classified as Turban 2, and of these, 12, or 6 per cent, were improved; 5, or 2 per cent, unimproved; 28, or 15 per cent, progressive; 53, or 28 per cent, quiescent; 85, or 45 per cent, arrested, and 2, or —2 per cent, dead.

Seventy-eight, or 22 per cent, were classified as Turban 3, and of these, 10, or 12 per cent, were discharged improved; 4, or 5 per cent, unimproved; 21, or 27 per cent, progressive; 29, or 37 per cent, quiescent; 8, or 10 per cent, arrested, and 6, or 8 per cent, dead.

Six hundred and thirty, or 64 per cent, were not treated with tuberculin, and of these, 76, or 12 per cent, were classified as Turban 1, and of these 8, or 10 per cent, were discharged improved; 4, or 5 per cent, unimproved; 3, or 5 per cent, progressive; 12, or 15 per cent, quiescent; 49, or 65 per cent, arrested, and 0 per cent dead.

Two hundred, or 31 per cent, were classified as Turban 2, and of these 21, or 10 per cent, were discharged improved; 11, or 5 per cent, unimproved; 21, or 10 per cent, progressive; 59, or 28 per cent, quiescent; 83, or 41 per cent, arrested; 9, or 4 per cent, dead.

Three hundred and fifty-four, or 59 per cent, were classified as Turban 3, and of these, 71, or 20 per cent, were discharged improved; 18, or 5 per cent, unimproved; 105, or 29 per cent, progressive; 90, or 25 per cent, quiescent; 27, or 7 per cent, arrested; 43, or 12 per cent, dead.

Conclusions. By means of the division of our cases into four equal time periods we hoped to be able to demonstrate more important facts than have actually resulted. The work has continued to grow throughout the four periods, less, however, as time goes on, which we attribute to the increasingly successful anticlimate campaign.

There has been an increasing percentage of cases unsuitable for treatment far from home, particularly noticeable during the last or fourth period. (See Chart I.) There was an improvement in the types of cases in the second period, but it has been getting worse ever since. As a matter of fact, we are getting an even larger number of those who have failed elsewhere, which fact is undoubtedly due to the increasingly successful anti-climate propaganda.

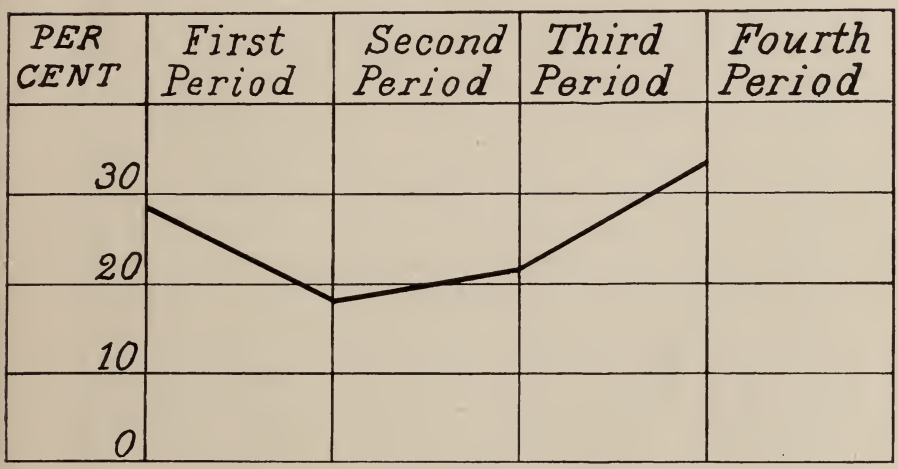

Chart I

The percentage of male and female patients has been practically constant for all periods. About 30 per cent are females, showing that it is more difficult to get the female tuberculous invalid to leave home than the male, probably explained by fundamental character differences and also by the fact that the responsibility for the care of children is more essentially a province of woman than of man.

In all periods the percentage of those presenting a history of exposure to tuberculosis in childhood, a history of delicacy in childhood, neither and both is about the same, indicating that under civilized conditions of life we are dealing with constant

factors in this respect. Their bearing upon results will be discussed later.

In all periods the percentage having fever on admission was about the same, namely, 63 per cent. This was also true of systolic blood-pressure, which on admission is normal for young adults, showing certainly that the immediate effect of a high altitude does not lower the blood-pressure, for in spite of the fact that practically all of our admissions are frankly tuberculous (tuberculosis tending to lower the blood-pressure), yet they present on the average a normal pressure. It naturally follows that if altitude has any effect upon blood-pressure it is to raise rather than lower it.

The percentage having elevation of pulse on admission is about the same as in all periods, 74 per cent. The percentage having anemia was quite variable in the four periods, probably due to different methods of estimating the same, all being more or less unsatisfactory. The number having impaired general condition and tubercle bacilli in the sputum (respectively 70 per cent and 87 per cent) was practically constant in all periods. All these facts taken together indicate the advanced type of tuberculosis that make the bulk of our work. The percentage of the different complications of tuberculosis is about the same in all periods.

The number having hemorrhage under treatment is much less than that usually reported. Night-sweats are so infrequent as to be unworthy of record.

It is worthy of note that 9 per cent of our cases presented some serious nontuberculous complications (from nephritis to valvular heart disease and aortic aneurysm), which often proved a direct cause of death.

By means of the division into four periods we were in the hope of being able to demonstrate that as a specialist in this disease acquires experience his results would reflect the same by getting better. If such is the case the improvement is within such a narrow range as to be, to say the least, not clearly demonstrable, as will be made plain later.

In considering status on discharge we are confronted with the

unvarying characteristics of tuberculosis under given conditions. Year after year the same percentages are discharged bacilli-free, without fever, impaired general condition or elevation of pulse. On only a very small number do we witness pulmonary change sufficient to justify an alteration in the Turban classification. Under sanatorium conditions, particularly, the evolution of the disease is very slow and the relatively few months we have these cases under observation is all too short a time to register change in pulmonary classification.

In view of the controversy that has occurred regarding the effect upon blood-pressure of altitude, it is worthy of note that the average systolic pressure upon discharge (120.4) is a little higher (on discharge) than upon admission (118), proving beyond question that residence in a high altitude does not lower pressure.

In all periods the percentage of early, minimal or Turban 1 cases has been the same, namely, 15 per cent. The rest have been divided between Turban 1 and 2; the larger percentages, in fact about half, of our cases have been far-advanced.

Regarding results achieved in our work we call attention to Chart II, which exhibits the arrests in all periods. It should be noted that the average length of treatment varied between 8.8 months in the first period, 9.5 months in the second, 10.5 in the third and the lowest of all, 7.9 months, in the fourth period. In general it may be stated that results will improve with increase in length of treatment, within certain limits, of course. No institution has as yet ever approximated the ideal in this respect. So far none of us in this work have anything to fear from too long treatment. There are exceptional cases in which the patient stays too long in an institution, but they are very few and can be disregarded. A very great majority remain too short a time for the best results.

With us the length of stay slowly increased until the fourth period, when it suddenly dropped to below even the first period. This is a direct result of Dr. Bullock's absence in the War, when the institution was left in inexperienced hands. The results following decreased length of treatment should also show a falling

off. This is true, as may be seen by referring to Table 1 only in reference to the third period in the Turban 1 class. In the first two periods the percentage of arrests is alike. There is a marked improvement in the third period in the Turban 1 cases, to which we will refer later. In the Turban 2 class, after the first period, there was a slight improvement each five years in the percentage of arrests, but the first period is remarkable, inasmuch as the percentage of arrests is better than in the Turban 1 class. In the Turban 3 class there was a steady improvement throughout all periods in the percentage of arrests. From these statistics

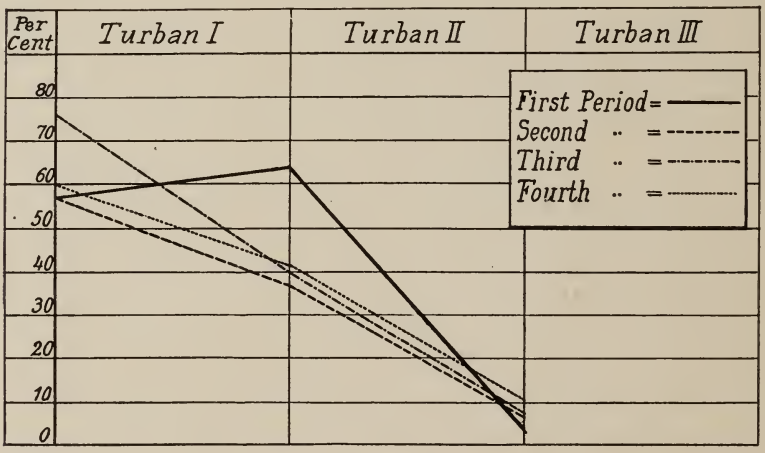

CHART II

we certainly cannot make it clear that one improves his results by increasing experience—there are too many contradictory factors. It ought to be true, and if true would be very consoling, to one whose lifework it is, but from our results we certainly cannot prove it. Take, for instance, the arrests in the Turban 1 class in the third period, which must excel the other three. This is the period during which the use of tuberculin was very general in our work. It is also the period of the longest stay. Is it not a fact that patients taking a routine procedure, such as a so-called course of tuberculin, are easier kept under treatment than others?

And may not the longer stay account for the better results just as well as to attribute it to tuberculin or increasing experience? We are rather of the opinion that about the only way experience can be translated into better results is by gaining better control

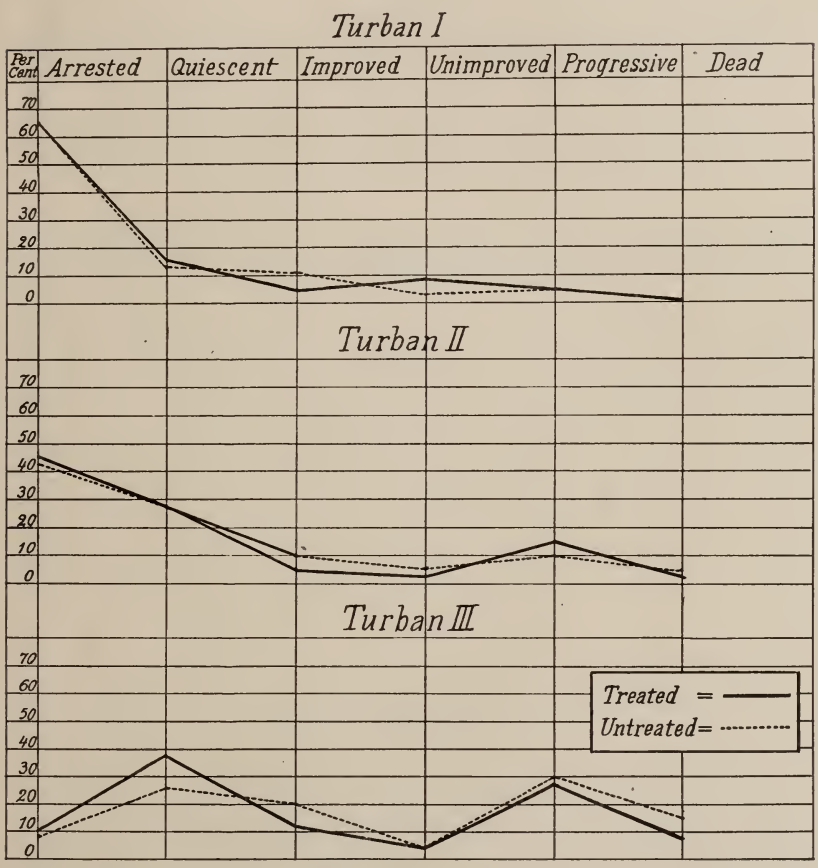

Chart III

of patients and thus keeping them on the job better and longer. Treatment of tuberculosis is itself standardized. None of us in this work have much individual advantage over others.

In regard to our use of tuberculin, we direct attention to Charts III and IV. Chart III gives the results in cases with and without tuberculin in all classes. Chart IV the arrests only with and without tuberculin. From these exhibits it is very plain that there is little difference between treated and untreated cases. (In this connection it is well to recall that no one has been able to show anything much for tuberculin by means of statistics), except in the third period, where tuberculin was very generally used. It is to be kept in mind that cases chosen for tuberculin treatment were those resistant to ordinary measures, so if results equal those

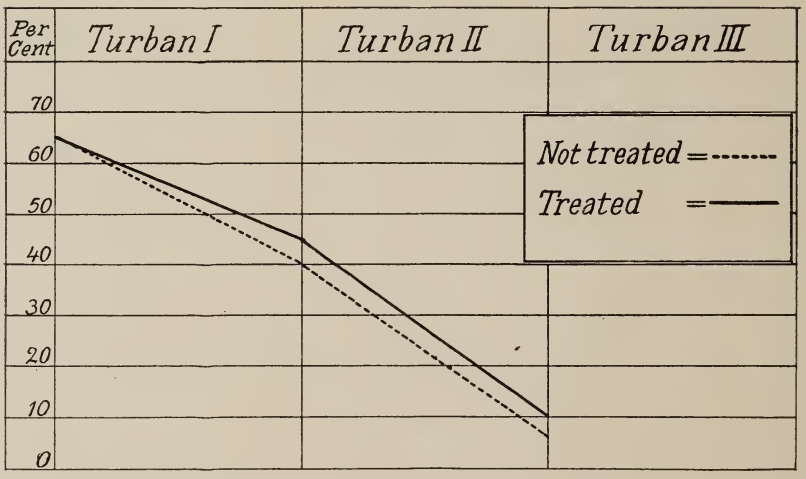

Chart IV

of the untreated cases there is reason to believe that it is of some value. In the Turban 1 types we achieved the same percentage of arrests with and without tuberculin. In the other two our results are a little better with tuberculin than without it. Our results seem to justify the conclusion that tuberculin is not necessary in minimal tuberculosis, but may be appropriately employed in the more advanced cases. It should not be forgotten that tuberculin-treated cases remain longer under treatment than others, and this may explain the slightly better results.

At all times tuberculin has been employed by us with great caution and close observation, yet without fear when well tolerated. From our exhibits it is worthy of emphasis that the careful use of tuberculin is absolutely harmless—a little the contrary in fact. Coinciding with the generally accepted idea, tuberculin therapy is one phase of treatment only, and its beneficial action, if it has any, is probably confined to increasing fibrosis around the foci of infection, thereby diminishing the permeability of the wall around the area involved.

There is one thing of great value which resulted from the division into periods, and that is the demonstration of the total

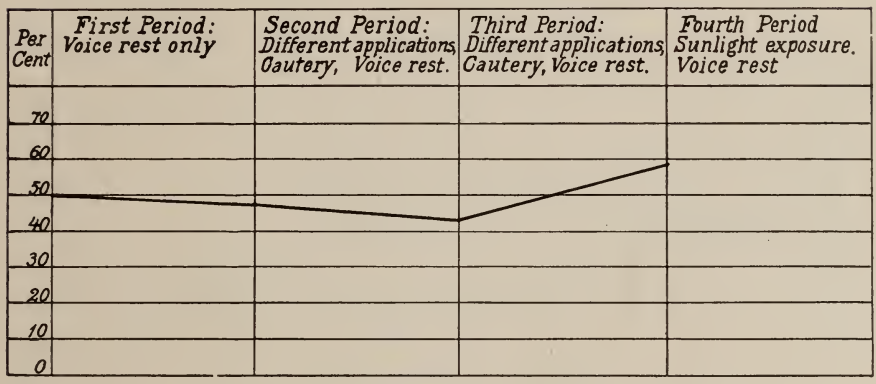

Chart V

lack of value—in fact, the harmfulness of laryngeal application of various sorts, including the use of the cautery and surgical procedures. (See Chart V.) In the first period nothing but voice rest was employed in the treatment of laryngeal tuberculosis, and healing occurred in 50 per cent of such cases, a splendid showing in itself. Thereafter for ten years all sorts of applications were tried and also cauterization with the actual cautery as well as amputation of the epiglottis in some instances—in addition, of course, to voice rest, and the results steadily fell off until the last period, when we started sunlight exposure and voice rest with a consequent marked improvement in laryngeal results. This

improvement from 44 per cent of healing to 57 per cent justifies a belief that there is real value in exposure of the larynx to the sun's rays. In this connection it should be recalled that the results are worse in the third period, which was the time when tuberculin was quite generally used. This may be of some significance, as tuberculin has been lauded as of use in these cases.

We now consider the effect upon results of a history of exposure and delicacy in childhood, either, neither and both. (Chart VI.) For twenty years one of us (Bullock) has kept careful records of the occurrence of these factors in our cases in the hope that some day they might prove of value. The statistics in the table and

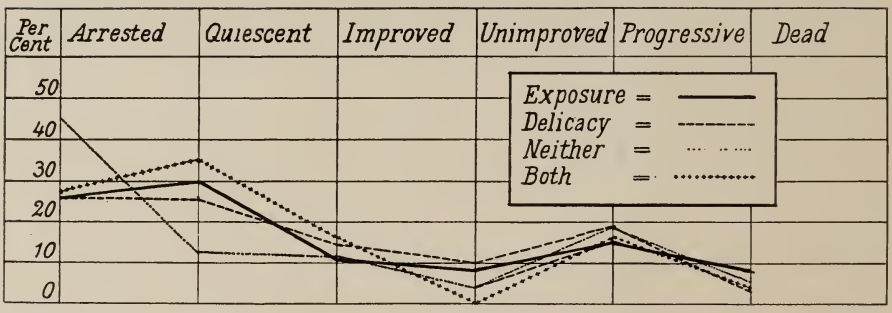

CHART VI

chart referred to were derived without reference to the stage of the disease, all three types being considered together. The cases having a history of neither exposure nor delicacy furnish about 10 per cent more arrests than when either occur. Taken separately both of these factors are of equal value in impairing chances for arrest. The percentages representing the occurrence of both in the same person should be desregarded, as the total number is too small to justify conclusions, namely, 7 per cent.

Both of these factors just discussed are insignificant in terms of relation to result compared to temperament and financial condition, a record of which has been also kept for twenty years. These are factors of the greatest importance, particularly financial

condition. (Chart VII.) These statistics are also derived without regard to classification of types. It may be seen that the highest percentage of good results is achieved when temperament and financial condition are favorable and the worst when they are both unfavorable, as might be certainly anticipated. It is also readily demonstrated that a good financial condition is more important than a good temperament, though not much more so. The highest mortality and the highest percentage of arrests occur when temperament and financial condition are favorable and the high death-rate and high percentage of arrests being attributable to the same thing, the fact that in both the patient remains long enough to thoroughly try out the case while those in which these factors are unfavorable pass from observation.

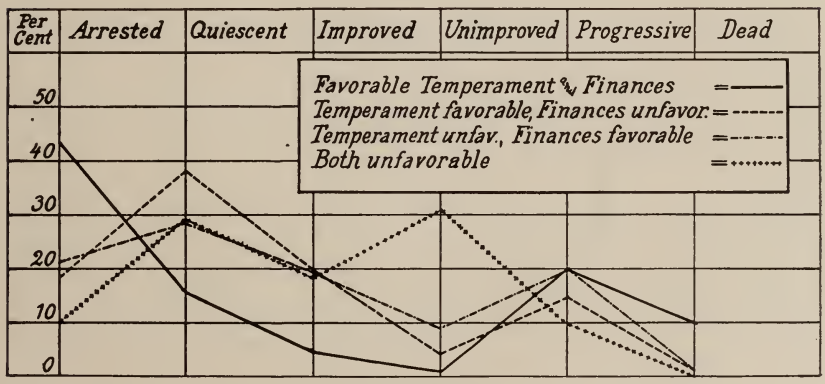

Chart VII

The effect of these factors is, however, much better shown by arranging the cases, illustrating them into the usual three types and then extracting the results. This has been done in Chart VIII. As shown, an ideal temperament and financial condition exercise great influence upon results, particularly financial condition. A fool with money enough may recover, although not very likely to, but a poor fool simply cannot. In the Turban 1 and 2 types the percentage of arrests, namely, 91 per cent and 61 per cent

respectively, are much better than in the same type, taking all cases together in which the arrests are 64 per cent and 42 per cent respectively. Naturally these or any other factors are of much less significance in far-advanced cases, the difference being but 1 per cent between them, and that in favor of the ones with favorable temperament and financial condition. The far-advanced types, with little hope at the best, have practically none without these factors are favorable.

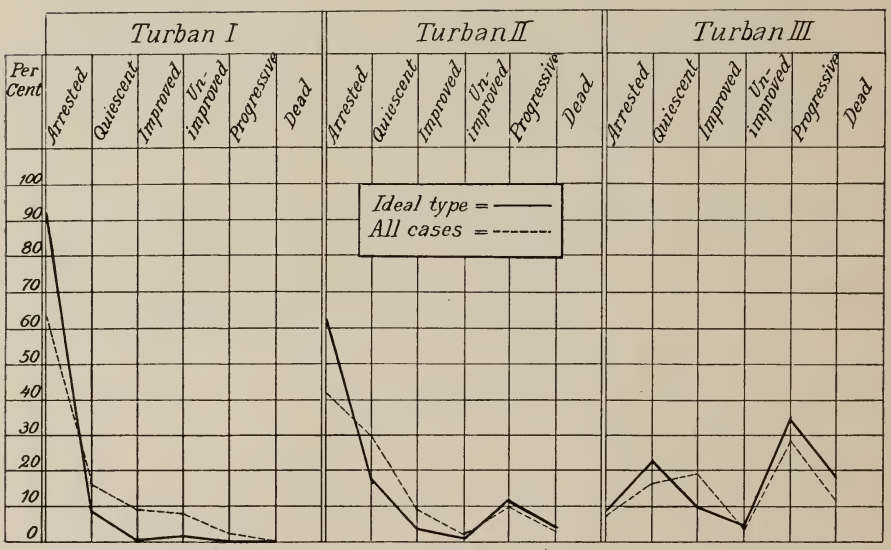

Chart VIII

From these statistics we have the right to conclude that the only practicable way open to improve results in the treatment of tuberculosis lies in getting more patients in the ideal class, and as financial condition is a matter entirely outside of our control, we must devote more time and patience to making the unfavorable temperament at least more favorable. There is too great a tendency to slide one's duty in these individuals just because it is disagreeable. We believe that possibly 5 per cent more good results can be achieved by working harder with the bad

patients. It should be worth anyone's trouble to save that many more lives. More time should be spent in the education of the patient, being especially careful not to minimize the time and effort necessary to recovery.

Chart IX illustrates our results in artificial pneumothorax, in which the results by this method are compared with the results in all cases. In these cases the good results bear relatively little relation to the degree of involvement, for the percentage of arrests is higher in the Turban 3 types. Of course the chance of accident and death is in direct relation with the degree of involvement.

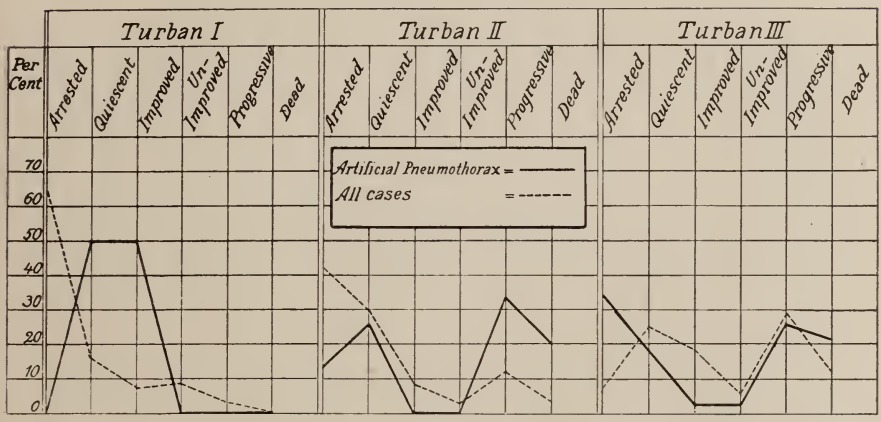

CHART IX

As might be supposed, except in the Turban 3 types, they show less favorable results than under ordinary treatment. This is, of course, due to the selection of progressive types only for compression; that is, cases which would terminate badly otherwise. This is and will continue to be our policy toward compression. In the progressive Turban 3 types the value of compression is quite apparent, though it is to be noted that the mortality is over 10 per cent higher than under the usual treatment. This is also true of the Turban 2 types, in which the mortality is 17 per cent higher than under the usual methods.

From this it appears that the beneficial results obtained are

often upset by the accidents of this procedure. We must not, however, lose sight of the desperate type of case selected for this treatment. Undoubtedly, and according to our method of selection, compression cases would show a very high mortality without compression, so that all we obtain by compression is pure gain. Although a disadvantage, we do not consider a slight involvement of the good side a contraindication. Some of our most brilliant results have been obtained in such cases, and 50 per cent of all our cases had some involvement on the good side.

We now reach the real purpose of this paper: The elucidation of the place of climate in the treatment of tuberculosis.

It has been maintained that there is no such thing as an ideal climate. As a general statement regarding climate alone that is incontrovertible, but we believe that, as far as the treatment of tuberculosis is concerned, there are a great many places in this country and in others which afford an ideal climate.

Such a climate is high, dry and cool. It is the combination of these three factors which make up the ideal climate for the tuberculous. With particular reference to the southwestern United States, there should be, in addition, freedom from dust storms and mosquitoes.

The very grave mistake has been made of exploiting the whole arid region of the United States as a health resort, which is absolutely not the case. An ideal health resort must be favorable at all times of the year. In our arid region we have nearly all possible varieties of climate except wetness. Dryness is the only factor held in common. We have places where the summers are so hot that one could about cook an egg on the pavement, and others with a summer so delightful that words fail to portray the real truth. We have places so cold in winter that one might as well be in the Adirondacks or the Selkirks, and places so modified by latitude, altitude and dryness as to be relatively warm in winter and others which have the winter climate of Egypt. We have places where there are frightful dust storms for four and five months out of the year. Such are totally unfitted to be health resorts. The well-known ideal health resorts of the West

are Colorado Springs, Colorado; Las Vegas, Santa Fe, Fort Bayard, Fort Stanton and Silver City, New Mexico, and Prescott, Arizona. For perfectly apparent reasons we do not mention Denver, Colorado, for it is a large city, and such are not ideal places for consumptives, regardless of climate. We will never utilize our western climates to the best advantage until more brains are applied to the question of where to go. We have vast areas perfectly suitable for consumptives, such as the Gila, Pecos and White Mountain Forest Reservations, but at present they contain none of the other essentials of proper treatment of tuberculosis—in other words, they are practically uninhabited.

In substantiation of our belief that there is an ideal climate we offer our results. We have no doubt that similar results are obtained at institutions having equally desirable climatic environment.

In Table VII are exhibited the results obtained at the Trudeau Sanatorium. Chart X also shows the results at the Trudeau Sanatorium. In these charts and tables he who runs may read the definitive reply to the anticlimate teaching of the past twenty years.

A critic may object that classification of tuberculosis is so difficult that even with a perfectly honest intent comparison of results in different institutions is unfair. To which we reply: Very well, let us abolish the classification and consider only those who are discharged better or worse. Surely anyone can tell whether a consumptive is better or worse.

What is the result? We offer Chart XI, which exhibits the good and bad results at the Trudeau Sanatorium, the new Mexico Cottage Sanatorium and at Fort Bayard, under the Army. They include altogether nearly 13,000 cases. In each and any class, and taken together without classification, the results at the two latter institutions excel the former, and the worse the class the better the results in comparison with those at Trudeau. In other words, the sicker they are the more they need what our climate has to give them.

It is evident that 24 per cent of our cases are not amenable to

our methods of treatment, and we feel that such cases are best treated at home; in fact, they are the type of cases that have instigated the anticlimate propaganda. Anyone who has spent

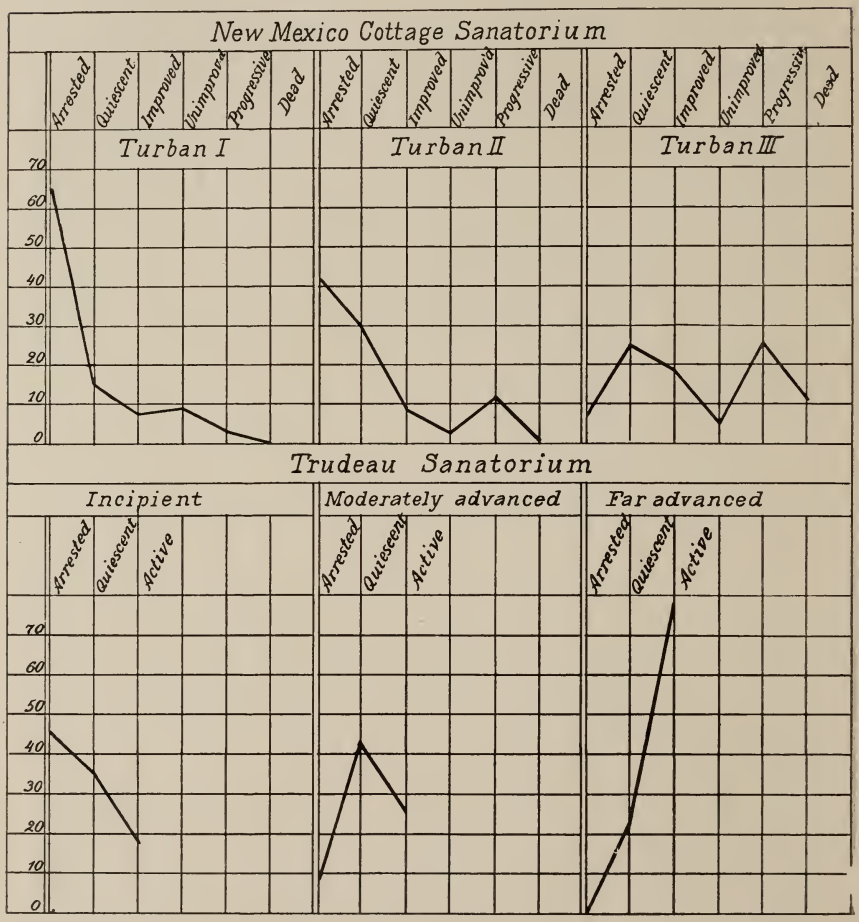

Chart X

time in observation in the Southwest of the migratory consumptive has been impressed with the pathos of the deluded wayfarer who comes here to camp out, draw water from the irrigating ditches, walk to town for his weekly supplies, do his own cooking

and washing, and after several weeks or so leave disgusted that the miracle has not come to pass. Nothing brings them to the physician except dire need of attention, usually a hopeless terminal complication.

The large number of the Turban 3 cases that come to us speaks for itself. They are the failures of elsewhere. But even so, they represent but the least number when one remembers that finances are such essentials in reaching this country.

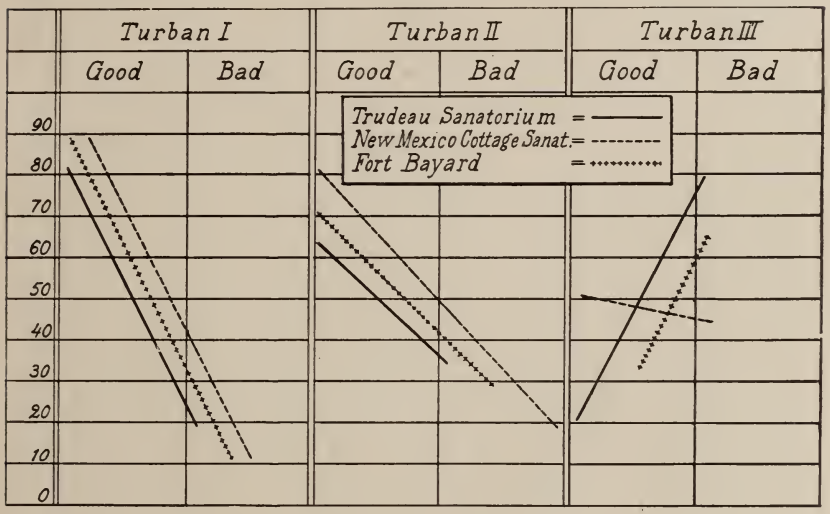

Chart XI

There is a widespread existing belief, too generally accepted and taught, that a sanatorium patient from the West relapses quickly on return to his occupation at his home; that an arrest or so-called cure made at home is more permanent. This is a statement to be challenged as to conscientious accuracy. The resulting relapse should truly be charged to improper treatment upon a patient's return to his surroundings and failure of local conditions to hold such patients at an adequate state of health.

Failure to hold a patient at the requisite good health is the rarest sort of happening when they remain under our surveillance

in this climate. In fact, there are numerous patients who have taken up their residence here who in time have become actual cures under condition of unusual stress, under which they have repeatedly failed at home. Whatever this may be due to, be it climate or care, it is to be noted that results from the Fort Bayard records are equal to ours and vastly better than any other group of records of which we have been able to obtain a copy. This is true of institutions richly endowed and long established, with medical staffs that merit our highest esteem. That climate has a vital influence on the end-result is to us and others a proved fact. If fresh air is a factor in the result of tuberculosis treatment, then the fact that patients can, in entire comfort, get more of it than any other place in the mountains of this soutwestern country should be an incontrovertible argument in itself.

That the Southwest has been maligned is true, and this without exhaustive investigation, if any investigation at all. Certainly it has been in our presence disparaged by men concentrating their efforts on tuberculosis in some of the large cities who to our certain knowledge have never been west of Missouri.

Although to our minds this paper is conclusive, and will, we think, appeal in the same way to the average person interested in this subject, still we believe that the time has come—for the good of humanity and the medical profession—when some authoritative body, such as the Rockefeller Foundation or the National Tuberculosis Association, undertakes an investigation of the records of Western institutions, and to settle the question forever make a final statement of the subject of "Climate in Tuberculosis."

DISCUSSION

Dr. H. R. M. Landis: I was very much interested in what Dr. Bullock has had to say regarding classification. I have come pretty much to the conclusion that anything that is based on anatomical lines is useless. I now depend entirely on whether the patient is toxic or nontoxic; and I am particularly concerned with the amount of damage in the lung, provided

that the patient is free from or can be relieved from toxic symptoms. I have acted as examiner for the Trudeau Sanitarium for twelve years and I am constantly forced to reject patients because of the standard that they have adopted there. Many people have too much damage in their lungs for me to send them to Saranac Lake. They come from out of the city and I have no means of knowing whether they have fever or other symptoms indicating toxemia. If I sent them home I do not know that I could get a picture of the conditions in a month or two. Only recently I rejected two cases that went to White Haven and, as the result of two months' treatment in bed, are entirely free from symptoms and are evidently suffering from a nonvirulent type of infection; yet, as far as physical signs go, I should not dare to send them to Trudeau.

In regard to tuberculin, I am glad that Dr. Bullock took the stand that he did. I think it is a useless remedy and one that was used for a long time because doctors deluded themselves into thinking that they got results from it when they never did; and some men are using it today on the basis of holding the patient or because their colleagues are enthusiasts and use it, and they are afraid that they will not be considered scientific if they do not follow this example. Tuberculin is a failure, and when we recall the thirty-two years in which it has been used consistently and thoroughly we realize that it has not been able to prove its value.

As to laryngeal lesions, I agree with Dr. Bullock that it is amazing how many of them seem to clear up with nothing but local rest; and it is amazing how laryngologists fail to grasp that fact and insist on patients coming to the office several times a week to have various solutions used without giving them directions for rest. There are certain types that active measures relieve. Sometimes swollen and edematous arytenoids are relieved by the use of the cautery; but most cases get well by local rest plus the direct rays of the sun.

Dr. Bullock's observation that those with no history of tuberculosis in the family do better than those with such a history is interesting. The question arises whether that does not fit in with Lewis's work with guinea-pigs, in which he has shown that certain families of these animals have a definite resistance to tuberculosis while in others the resistance is almost *nil.* I think that we shall be able to show that there are families that go back generations in which tuberculosis has never appeared and other families in which the disease is cropping up all the time—perhaps as the result of direct exposure but more on account of a low resistance due to an inherent weakness; so that the members of the families that are tuberculous take the disease relatively easily.

There is no question about the financial aspect of tuberculosis. There are hundreds who, if they only had the money, could be cured. It is a

matter of record at White Haven, and also at the Phipps Institute, that people whose lives have been spent in the slums are living under very difficult circumstances. Very often when you have them a few months in the sanitarium their resources are gone and they have to go back to work in order to support their families; and they are almost sure to relapse. Whereas if we could keep them from nine months or a year the results would be far better. The disease is still a disease of the pocketbook.

I do not think that a sanitarium does anything to anyone except to get the disease quieted down and teach the patient how to live. When patients step out of the sanitarium a certain number of them will relapse. Many cannot adapt their lives to their physical condition, and, naturally, the results will be bad. Those who can adapt their lives to their physical condition will usually do well. People who do not have to work and can live where they please cannot be compared with those who have to get out and battle with the world, and keep at it. These factors are always to be taken into consideration.

I think, again, that this holds true of those cases that Dr. Bullock speaks of. Of course the soldier may be a bad type of case, but the fact remains that you have him under discipline. The difficulty with many of these people is the ability to keep them sufficiently long. That is often the stumbling-block at White Haven. The patient progresses to a certain point and then must leave. The result is that we have a large proportion of cases relapsing; the surprising thing is how many get well and remain well. The question in many cases is not the amount of damage in the lungs but of how toxic the patient is. Curiously enough the first four patients that I saw when I started this work were at that time advanced cases with cavities in their lungs. All are well today. All have bacilli in their sputum and all are leading useful lives. Are they arrested? I do not know. I often think of the case of Dr. Trudeau himself, who had sputum with bacilli in it for forty years. He always had them, but his disease was stationary in spite of that fact.

Dr. Thomas D. Coleman: I beg to thank you for the courtesy of the floor, and to assure you that I will not abuse your patience very long. I think that Dr. Bullock is to be congratulated on giving such an accurate account of his work for the past twenty-three years. It would be impossible, in this discussion of a few minutes, to analyze his tables. That is something which can be better done when the paper is published.

As I take it, in supporting his plea, as to the value of climate in the treatment of tuberculosis, he fired something of a broadside into the ranks of those who claim that climate is unmaterial. His wind-up, which amounts to a comparison of his results with those at Saranac Lake, would

certainly seem to give him the advantage in the number of recoveries. It would seem that a greater proportion of this number would have to be credited to climate. Personally, I am a very firm believer in the beneficial effects and the untoward effects of climate in the treatment of this disease. I believe firmly that tuberculosis can be treated by intelligent men anywhere and good results obtained, if you can get the coöperation of your patients. You cannot lay down any hard-and-fast lines for all types of tuberculous patients any more than you can for any other disease. Some patients will thrive in one climate and go down in another. There are so many other elements in the treatment of the disease that have to be considered also, but, putting the question broadly and baldly, I believe that under equal conditions, under the direction of a competent man, and with a patient of equal financial and temperamental condition, the patient will recover faster and more surely in a climate that is fairly equable and where the percentage of sunny days is relatively large.

I think that you have to consider, of course, as has been said, the financial condition of your patient. You have to consider the temperament of your patient. Take a phlegmatic individual who will take life philosophically, and his tuberculosis not too seriously, and ship him to a distant climate and he will get along relatively well. On the other hand, if you take a sensitive young woman or man, a patient who is apt to exaggerate all the difficulties of the situation, that patient will not improve even if you send him or her to the most beneficent climate in the world. The absence of home surroundings, of home interests, of home people interested in him, has its effects. Personally, I should prefer, if I were sending my patients away, to send them where they would fall into the hands of a good, intelligent physicians, rather than to a good climate.

One point that Dr. Landis stressed I should like also to mention in this connection: The percentage of cures where there has been a history of exposure. He brought out the fact that there is a susceptibility to tuberculosis in certain persons, and I should like to point to the fact that there is also a racial susceptibility. You may take the Indian, the Negro, the Esquimaux—all are susceptible, not perhaps due to their race *per se*, but more likely their mode of life and to lack of previous exposure that the Indian and the Negro are more susceptible. I believe that our Hibernian friends are also more susceptible, probably because their life was formerly bucolic, while now, in our country to which they have moved, they live for the most part in densely populated cities. The Jew, on the other hand, is singularly immune. I cannot close without deploring the practice of sending advanced cases to any climate whatsoever, away from home. If their financial resources are limited it frequently is an embarrassing

burden to the region in which they land, and always involves heartache, and oftentimes absence of the comfort that could be obtained at home.

Dr. James M. Anders: I recall a time when, almost as soon as the diagnosis of tuberculosis was made, the patient was told to migrate, usually to the Far West, to certain resorts having more or less reputation. Some of those patients did very well in their new locations. Others, however, did not; and when Dr. Coleman was speaking the advice of the late Dr. Delafield occurred to me. He said (soon after I began the practice of medicine) that a patient should migrate from place to place until he found one in which he felt well, could eat well, could sleep well and gain flesh and strength. I later found, from observation and experience, that patients could follow that advice with marked advantage. This recommendation is, of course, not so important, at the present day, as at that time.

Later on the sanitarium treatment was introduced in this country by Trudeau, and, as you know, has been steadily gaining in reputation and popularity since then. At the present day it is commonly considered that the conditions are more ideal in a sanitarium than anywhere else, more particularly for the early cases; and I cannot help feeling, with Dr. Coleman, that a sanitarium located in a certain selected climate is better than the usual one at home, as a rule. I still believe in the virtue of climate as does he, and I have always felt that the climatic requisites of greatest importance were purity of air, equability and abundance of sunshine.

Now we do not look for purity of air and equability of temperature so much in urban localities, but rather to the mountains and virgin forests, where these resorts were usually located in the past. Equability has reference especially to the absence of marked diurnal ranges of temperature and humidity—in temperate climates— a fact too often lost sight of, so that sanitariums located in the neighborhood of extensive forests are usually favored in this respect. Forests tend to minimize the diurnal variations of temperature and cool the air in summer. This is more important, to my mind, than are the seasonal variations. I think that we should also remember that in laryngological cases the pine forests offer advantages not possessed by other places.

After all more than one-half of all cases of tuberculosis must be treated at home and cannot even be sent to a sanitarium. Therefore it seems to me that the medical profession should, now that we know the great advantages of a sanitarium, know what the advantages are that it possesses for the patient as ordinarily located in nonurban localities and endeavor to surround the patient at home with the same conditions that exist in a

sanitarium. He should be taught the same lessons that he would learn in the sanitarium; he should be subjected, as far as possible, to the same rigorous discipline. It is surprising to what extent we can approach sanitarium treatment at home if we give sufficient time and attention to the individual cases. Living out of doors and proper feeding can be arranged for, and the well-known favorable influence of suitable environment, in a measure, at least, maintained. There are physicians experienced as phthisiotherapists who believe that patients can get well as readily at home as elsewhere, and I think Dr. Coleman has written on that subject; but I wish to say that, other things being equal, and the finances of the patient permitting, it is best to send him where the conditions are ideal—that is, sanitarium in a suitable climate, *e. g.*, such as that presided over by Dr. Bullock.

I subscribe to the opinion that tuberculosis can be cured anywhere, and that any one of the agencies that are now employed to bring about a cure can be dispensed with; but I feel that when you can add 10 to 20 per cent, possibly, to the chances for cure by sending the patient to an ideal place, it is wise to give the patient the benefit of the advantages which it offers.

Dr. E. S. Bullock (closing): In reply to Dr. Landis's criticism of an anatomic classification, I will simply say that an anatomic classification always appealed to me as foolish, because it did not take any account of degrees of toxemia; but that after doing the classification both ways, that is, according to Turban and according to the scheme of the American Sanatorium Association, and finding that both gave practically the same results, it was borne in upon me that the actual geographic area involved is the final and determining factor in every case of tuberculosis.

There is one thing that we must consider, and that is, "For all practical purposes, once a tuberculous invalid always a tuberculous invalid." When we say apparent arrest, quiescence, activity, etc., they are, I think, relative terms. For instance, when I took my army physical examination at Fort Bayard, based upon my rales and not taking into account that I had been clinically well for twenty-five years, Col. Bushnell turned me down for army service. But when the pinch for specialists came he promptly called me out and let me go to France with a left apex full of rales. So we have to keep in mind the relativity of the terms we employ in tuberculosis. We people who get better of tuberculosis must always consider ourselves as consumptives. It is only by living in a certain way that we can go on living—by going to bed early and doing other things of that kind. In other words, never forgetting our sanatorium lessons. There are only a few people who both can and will lead such a life. For the

poor, tuberculosis is always an unmitigated misfortune, for no matter how good the sanatorium result achieved, when they return to a normal life they will in all probability relapse and die within a short time. We must figure out what we can do for these poor people turned out of sanatoriums with a relatively good result. In Minnesota they are trying to make farm colonies for them. Social economics are very complicated, but there is little sense in spending millions of dollars on care and treatment in state sanatoriums, where these people go and get fat, and then turn them out to meet the exigencies of life and finally die of their trouble just the same. You might as well let them die in the first place. It would be, economically, a more sound doctrine. The morbidity of tuberculosis, as we all know, has been vastly lowered, but I doubt if we are doing anything with mortality records that is worth considering at all.

In Dr. Coleman's remarks I see nothing to which I must reply.

I would like, however, to correct Dr. Anders's impression regarding equability in the Southwest. In very dry countries there is no such thing as equability. We have an enormous diurnal variation of temperature, which acts as a very great tonic upon sick people. We consider our absence of equability one of our primary essentials. God made Hawaii and San Diego, Calif., for nephritics and high blood-pressure cases. They have almost complete equability. Likewise he made the Southwest for the consumptive. The matter of fresh air has been greatly overestimated. It is not so much fresh air as moving, cool air which is desirable in tuberculosis. Our patients should receive its impact every day in the year.

I wish to express my appreciation of the kindness and courtesy with which my paper has been received.

CARDIOVASCULAR FINDINGS IN WOMEN UNDER ANTISYPHILITIC TREATMENT[1]

By JOHN H. ARNETT, M.D.

I HAVE been invited to speak to you upon the subject of cardiovascular findings in women under antisyphilitic treatment. This is a subject in which I have been particularly interested since a year and a half ago, when I was asked by Dr. Thomas Llewellyn (who, under Dr. Clark, is in charge of the gynecological dispensary at the University Hospital) to make a routine heart examination of the women who were coming every Saturday to receive antisyphilitic treatment.

Although mentioned by several of the older writers, Hunter doubted the occurrence of syphilis of the cardiovascular system. However, in 1856, Ricord described a case of gumma of the ventricle, and in 1858, Virchow described the pathological anatomy of cardiovascular syphilis. In 1901, Grassmann,[2] of Munich, made a clinical study of the cardiovascular system of 288 cases of early syphilis and reviewed the literature of the subject. The wealth of material at his disposal and the unique opportunity for study which the control of syphilitic women by the Munich police gave him have caused his work to be very widely quoted. In this country, since 1913, Brooks[3] has given us the results of his observations upon syphilitic patients in the City Hospital of New York, and Warthin,[4] in 1914, described the demonstration of spirochetes in the heart muscle of a large number of syphilitics coming to autopsy.

[1] Read June 7, 1922.
[2] Deutsch. Arch. f. klin. Med., November, 1900, lxviii, 455.
[3] Am. Jour. Med. Sci., October, 1913, cxlvi, 513.
[4] Ibid., May, 1914, cxlvii, 667.

While many writers follow the lead of Grassmann, and hold that in most cases of syphilis, even in its early stages, abnormalities of the circulatory system are the rule, yet this view is not shared by all clinicians. Mackenzie,[1] for instance, believes that the symptoms complained of in early lues are not generally due to circulatory disturbances but rather to nervousness.

Technic. The cases which come to the gynecological dispensary for treatment, and of which this study is composed, are by no means a selected group. They come from all departments of the University Hospital and have in common only this, that the Wassermann reaction of the blood is definitely positive, or, if doubtfully positive, other evidences of syphilis are definitely present. The statistics which follow are based upon a single standardized examination of 114 cases regarded as syphilitic. For comparison a series of 50 supposedly normal young women were examined in the same routine fashion, 30 being social service workers about the hospital and 20 being cases from the gynecological dispensary with negative blood Wassermann reactions. The average age of the controls was thirty-three years while in the syphilitic group it was twenty-eight years.

Let us now examine the first chart on which the histories of norms are contrasted with those of syphilitics. Probably the most striking thing in this study is the infrequency of cardiac symptoms in syphilitic patients. The group labelled "Heart Trouble" represents those who had been told by a physician that they had heart trouble. The second chart is a comparison of the physical findings in the two groups.

The blood-pressure determinations were made by auscultation with the patient seated. In the syphilitic group the average pressures were 114 systolic and 74 diastolic (reading the fourth phase). In the control group the readings averaged 113 systolic and 72 diastolic. Although this difference is negligible, yet it will be seen by glancing at the first two columns that there were more cases of hypertension and hypotension among the former

[1] Oxford Medicine, ii, 335.

than among the controls. No cases of arrhythmia were noted among the norms either before or after exercise, while a few of the syphilitic group exhibited some form of disturbance of rhythm, usually extrasystoles.

The pulse-rate was first taken with the patient seated, next immediately after exercise, finally two minutes later. The exercise consisted in squatting twenty times with the back straight,

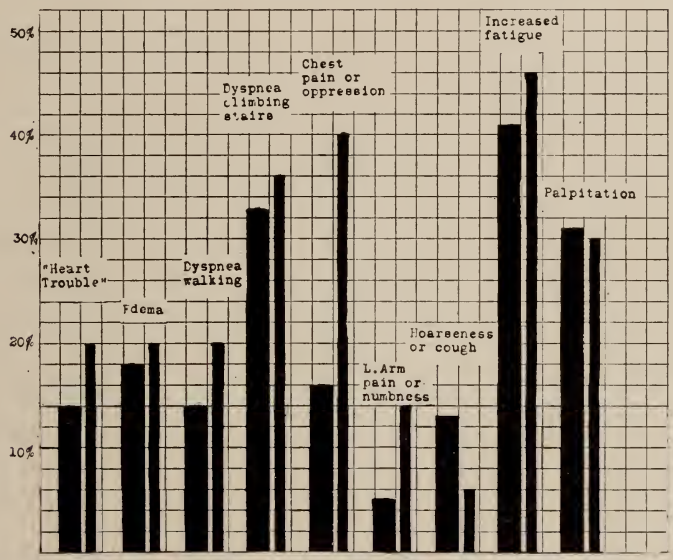

FIG. 1.—Comparative frequency of histories of abnormal cardiac conditions in 114 syphilitics and 50 norms.

touching the fingers to the floor each time. The pulse-rates, which did not return within two minutes after exercise to within 10 per cent of the rates at rest, are included in the column labelled "Diminished Exercise Tolerance." It will be seen that both here and in the preceding column the syphilitic cases diverge decidedly from the normal. In addition to the charted observations the following averages were obtained:

	Controls.	Syphilitic.
Average pulse-rate at rest	81	84
Average pulse-rate after exercise	109	121

Similar findings are recorded by du Castel,[1] who made observations upon syphilitic soldiers.

Electrocardiographic evidences of myocardial disease are shown in the next column to be somewhat more common in the syphilitic cases than in the norms.

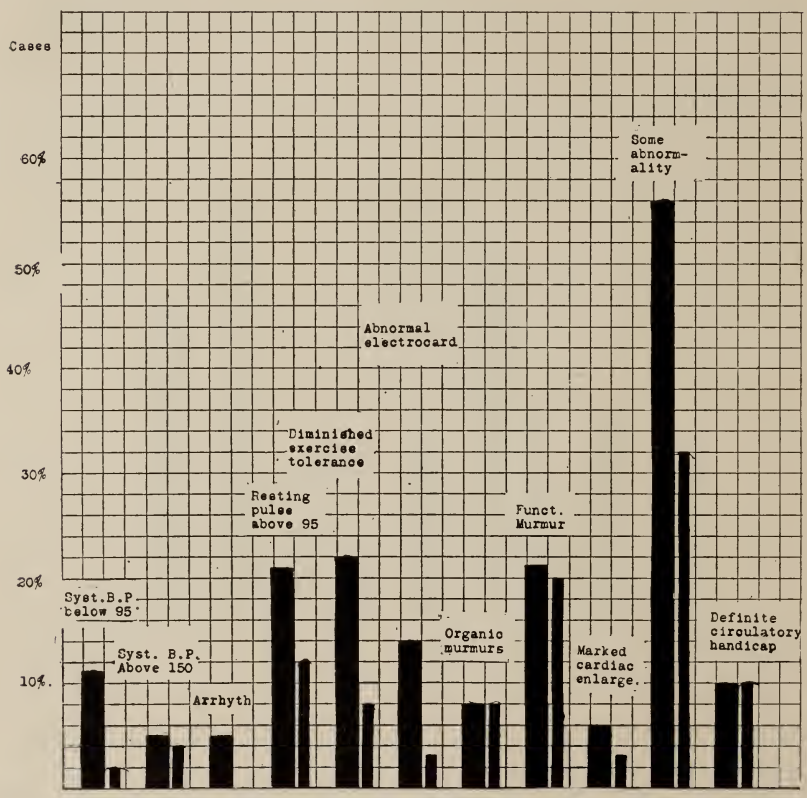

Fig. 2.—Comparative frequency of abnormal cardiovascular findings in 114 syphilitics and 50 norms.

Cardiac murmurs were present in a surprisingly large proportion of each group, but apparently the presence of syphilis in women of this age does not increase the percentage of murmurs.

[1] Bull. et mém. Soc. méd. d. hôp. de Paris, January 24, 1919, xliii, 31.

Cardiac enlargement was here estimated only by percussion, and a heart was called markedly enlarged when the left border measured more than 11 cm. from the midline.

The next group shows the comparative frequency of some abnormal cardiac finding in the two groups, and includes both severe and trivial cardiac disabilities. The group labelled "Definite Circulatory Handicap" contains Cases with disabilities of sufficient severity to exclude the subject from such occupations as school-teaching or nursing.

In conclusion, it may be said that in this series of 114 young women believed to be syphilitic and 50 control cases surprisingly little disturbance of the cardiovascular system was found which could be attributed to syphilis. Tachycardia and poor response to exercise were among the most striking of the positive results obtained.

I wish to acknowledge my indebtedness to Dr. Wolferth for his careful electrocardiographic studies; to Dr. Ravdin and Dr. Foote and to the medical students who gave their assistance; to the workers who acted as controls, and to the social service department of the hospital for its assistance and coöperation.

DISCUSSION

Dr. John H. Musser, Jr.: I think this paper of Dr. Arnett's is extremely interesting, and it is interesting to me from several points of view. In the first place I was rather astounded at the fairly recent date at which the cardiovascular system has been found to be, or known to be, rather, the seat of syphilitic disease. I remember very well when I was a resident at the Pennsylvania Hospital that a great deal of interest was felt at the time in the isolation and the staining of the spirochetes in the aorta, and that was only about fifteen years ago, perhaps less than that. So it is really comparatively recently that we have known that syphilis attacks the cardiovascular system. I think, considering the figures of Dr. Arnett, we must bear in mind the fact that most of his patients were young individuals. It takes a comparatively long while in the life-cycle of a syphilitic to develop the cardiovascular disease that we recognize as

such, that is, aneurysm of the aorta, myocardial disease and so on; but I think that he has shown by the two criteria that we can recognize early in the syphilitic changes in the heart, by the pulse-rate, of beginning myocardial insufficiency as well as by the functional test, and I think for this reason alone that this paper is well worth hearing and well worth being brought to the attention of the medical profession.

Dr. Hobart A. Hare: I listened with a great deal of interest to this valuable paper—valuable because it will serve to call the attention of the profession to a point which has been emphasized recently, particularly by Warthin, and has not received the attention that it deserves. I think if the older type of patient had been examined a syphilitic impairment of the cardiovascular system would have been found more marked. I hardly expect to find much invasion of that system in people of this age, particularly in women. I think there are greater lesions in men of this age and that our examination of people twenty years older would reveal a very marked difference. One thought occurred to me which, possibly, was not mentioned by the author of this paper. I was, unfortunately, called out of the room during the latter part of it. As I understood him there are no records of weight in these patients. Certainly, a stout woman squatting twenty times on the floor is much more likely to have variations in pulse-rate and pressure than a lean woman of that age. So, too, the proportion of these women who had borne children and who had, therefore, a certain amount of relaxation of the abdominal wall and enteroptosis—because many women who have enteroptotic conditions have with that vascular or cardiovascular disturbance, so that very little exercise causes them to have shortness of breath because of congestion of venous trunks in the abdomen. In future series some record of weight and some record as to enteroptosis would be of value. The most notable point about this communication is that it would seem to prove so little effect has been produced by the syphilitic virus. My impression has been otherwise, for the worst cases of cardiovascular disease that we meet are undoubtedly due to syphilitic virus, for I can recall case after case. These cases might be divided into two classes: One class, comparatively rare, that is, young people of thirty or thirty-five who begin to get cardiac symptoms, and, contrary to the general teachings, who get wonderful benefit from neoarsphenamin, and the older type, with marked cardiac symptoms, in whom the general teaching that these synthetics or compounds are dangerous and in whom we get very little result. In cases of premature senility due to infection, these arsenical compounds have to be used with great caution. As a type of the benefit of neoarsphenamin in young persons with cardiovascular syphilis, I have in mind a young physician who became

infected in his forefinger. He had no idea he was infected, but had manifestations of a failing myocardium, and after a number of doses of neoarsphenamin seemed to become perfectly well.

Dr. Joseph Sailer: I would like to ask about the contributory causes, particularly of the syphilitic cases. Had many of them been exposed to alcoholism or other modes of life that might have led to more early exhaustion than would be normal? I would also like to ask about the results of electrocardiographs. The changes commonly found in syphilis in well-marked cases are left ventricular preponderance. This occurs as the result of aneurysm or of lesions of the aorta. The prolongations of the *P–R* intervals, possibly the earlier changes in this respect, might have been noted if found they would be interesting. Was the *P–R* interval in normal and syphilitic cases measured and was there any average difference found in the two?

Dr. John H. Arnett: I was very much interested to hear Dr. Hare mention the question of age, because we also have considered that age played a very important part in the appearance of cardiovascular signs in syphilis. In this regard I would like to say that the average age of my cases was twenty-eight years and that it is rather interesting to compare this with the age of Brooks's cases; in 200 of his cases the average age of the women was thirty-eight and of the men forty-five years, and you will recall that Brooks found a very much higher proportion of cardiovascular disturbances than we found in our clinic. Grassmann's cases were about the same age as ours, but they were all either in the secondary stage or very close to there; whereas ours were only 11 of them in the secondary stage. As regards weight, we also came to the conclusion that we should begin keeping a record of the weight of the patients, and we are now doing that, although at the time when this series was begun this was not done. In regard to pregnancies, we do have a record of how many children these women have had, and there are also other possible causes for cardiovascular disturbances, such as pelvic inflammatory disease, which is present in a rather high proportion of cases, but which I have not incorporated in this paper. As regards alcohol, Dr. Sailer, I do not think we have any data whatsoever on that point, but it would certainly be safe to say that more of the women who are being treated for syphilis are exposed to that form of intoxication than the normal individuals who were examined. I had hoped that Dr. Wolferth would be here to discuss a little more at length the electrocardiographic findings and I regret that I cannot answer all the questions you asked. Dr. Wolferth made the studies, and he did not find a very high percentage of left ventricular preponderance.

THREE CONGENITAL ANOMALIES[1]

By JOSEPH SAILER, M.D.

Aplasia of the Left Pectoralis Major.

H. V. M., aged twenty years, was referred to me in December, 1919, by Dr. Lambichi. He complained of palpitation. He had a slight cough with expectoration, and there was some eructation after eating. He had used tobacco to excess but had ceased to use it shortly before I saw him. His father had died at the age of thirty years, supposedly of heart disease. Otherwise the history was unimportant. He was athletic and wrestled.

Upon inspection there was deformity of the left side of the chest and deficient expansion of that side. The deformity was due to the absence apparently of the whole left pectoralis major. The nipple was elevated on that side and situated in the third interspace at the edge of the fourth rib. The ribs and intercostal spaces were clearly visible. The pectoralis minor seemed larger than on the right side. No other muscular anomalies could be detected through the skin. The left side during inspiration moved less than the right side. Upon percussion the left side was hyperresonant. Cardiac dulness extended from the right parasternal line to the left border of the sternum, a distance of 11 cm. A faint diffuse pulsation was felt over the heart, but there was no localized impulse; perhaps the pulsation was slightly stronger in the eighth interspace at the right border of the sternum. The respiratory movement of the bases of the lungs was equal and normal. The

[1] Read June 7, 1922.

heart sounds were clear. There was no accentuation of any of the sounds. The lungs were normal with a slight increase of the vocal resonance at the right apex. All the movements of the left arm were easily and normally executed, and the patient told me that he was an expert wrestler and all-round athlete. The blood-pressure was 135 and 86. The blood and urine were normal. The gastric contents were strongly acid.

A year and a half later he was seen again. The palpitation had ceased for a time but had returned, and during the paroxysms he felt shortness of breath. He was engaged in business, had ceased athletics and had gained fifteen pounds in weight. His blood-pressure then was 124 and 82. The gastric contents contained no free acid.

Aplasia of the pectoralis major is rare, but the unexpected discovery of a heart displaced to the right indicates that it is not the only disturbance of growth present. Neither the physical examination nor the teleroentgenogram suggests any reason for this displacement. The right and left halves of the diaphragm were at the same level, and Dr. Newcomet reported that in the fluoroscope they moved equally. The lungs are normal and contain no shadows. The electrocardiogram indicates a slight degree of left preponderance, probably postural, but there is no evidence of dextrocardia.

I can offer only as a supposititious explanation that there is hypoplasia of the right lung. Some years ago, in performing an autopsy upon a case of left eventration of the diaphragm, it was found, as a reason for the eventration, that the left lung was about half its normal size and divided into four small lobes. Riegel has also reported cases of hypoplasia of the left lung with displacement of the heart to the left, and a hypoplasia of the right lung in this case with compensatory enlargement of the left would produce the conditions found in this case.

The anatomical diagnosis, tentative and made *in vivo*, is therefore aplasia of the left pectoral muscle, hypoplasia of the right lung and displacement of the heart to the right.

The literature of this condition is large but not particularly

varied. It may involve one or both sides. There may be displacement of the nipple of the breast or entire absence of the breast. The growth of hair is usually less on the affected side. There may be a hypoplasia of the side upon which the defect exists. Sometimes the arm is smaller and the skin may be altered. There may be loss of subcutaneous fat which is probably more apparent than real, and there may be a fold of skin across the upper portion of the chest. It has been noted in two cases that when the breast was absent in women there was an absence of the ovary on the same side.

Lengsfelder, who analyzed very briefly 22 cases and reported 1, notes that these patients, in spite of defect, may be extremely athletic. He also calls attention to the frequency with which the lungs may be involved. In none of the cases that I have seen in the literature is there any mention of symptoms referable to the heart nor mention of the position of the heart, but I have by no means exhausted the literature.

Other anomalies in these cases have been occasionally noted, and it may be said that aplasia of the pectoral muscle is a congenital deformity sometimes without other lesion, but not infrequently associated with anomalies in other parts of the body.

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Patulous Ductus Arteriosus

W. W., a boy, aged fifteen years, was referred to me by Dr. Clarence R. Faries. He complained of feeling rather tired in the morning, very slight dyspnea and frequent slight nosebleed. The history was rather interesting: At the age of one and a half years he had had a severe attack of bronchitis, and after this a murmur was heard over the heart, which the physician diagnosed

as endocarditis following an attack of bronchitis. This murmur has been present since then. His weight, 131 pounds, was excellent for his age and size. His color was normal. His tonsils had been removed at the age of twelve years. The axillary glands on the left side were distinctly palpable. There were no abnormal pulsations felt over the heart, but there was a distinct suprasternal pulsation. The area of cardiac dulness by percussion was: Right parasternal to left anterior axillary line, by measurement, 5 cm. to the right and 13 cm. to the left of the median line. Pulsation was felt in the fifth interspace, extending from the left parasternal to the left anterior axillary line. It was 5 cm. broad. The impulse was powerful and heaving in character, and there was a faint diastolic shock and a systolic thrill accompanying the impulse. Along the left border of the sternum there was a strong systolic and very prolonged diastolic thrill. To the right of the sternum there was a powerful diastolic shock. The pulse volume was increased in the horizontal position. Although the pulse was very full it was not of the Corrigan type. The pulse was 84. After exercise, hopping fifty times on one foot, it increased to 104, but there was no distress, and in two minutes it returned to the normal rate. At the apex there was a loud first sound, short systolic murmur and a loud second sound. Along the left border of the sternum, increasing in intensity upward, there was a loud systolic murmur, and at the pulmonic cartilage a continuous bruit and what seemed to be an added systolic murmur rather than an increased intensity of the bruit. The second pulmonic was accentuated. At the aortic cartilage there was a moderate systolic murmur and a fairly loud second sound. In the vessels of the neck there was a systolic murmur and a moderate second sound. This systolic murmur was also heard in the subclavian artery and in the carotids. The lungs appeared to be normal, but over all parts of the lung a loud systolic murmur could be heard. The abdomen was normal, with the exception that the stomach was moderately ptosed. In the femoral artery there was an extremely loud systolic shock, or Traube's sign, and upon slight pressure a systolic murmur was easily elicited, but there was no

diastolic murmur. The veins in the back of the hand collapsed at the level of the heart. The blood-pressure in the arm was 100 and 30. There was no fifth phase. In the leg the blood-pressure was 110 and 30.

This patient was examined one month and a half ago, and there was no change. He was moderately athletic, playing tennis and not tiring. On this occasion the blood-pressure in the arm was 120 and 30, and in the leg 155 and 55. The electrocardiogram showed very marked right preponderance. The cardiac axis was 100 degrees. The roentgen-ray examination was made by Dr. Pancoast, who reported as follows:

"The fluoroscopic examination showed a decided prominence of pulsation in the region of the pulmonary part of the curve on the left side. This was confirmed by the teleroentgenogram, which showed the prominence very plainly. The heart was not enlarged."

Dr. Pancoast made the diagnosis of patulous ductus arteriosus by the fluoroscopic study and the plate.

The chief interest in this case is the confirmation of the physical examination by the roentgen-ray study. The discovery of the characteristic changes in the heart by the roentgen ray was first made by Zinn in 1898, who found that the chief features were that the heart shadow on the left side was enlarged in its natural area, and in extreme cases appeared as a ball-like prominence. The pulmonary artery was enlarged and its pulsation was more vigorous than that of the aorta—in fact, as if it were actually distended. These findings have since been confirmed by a number of roentgenologists, whose work has been summarized by M. J. Hubeny, *American Journal of Roentgenology*, 1920, vii, 23.

The physical signs of a patulous ductus arteriosus are particularly a curious murmur, first described by Gibson, and consists of a long thrill following the systolic impulse and a palpable second pulmonic shock. The thrill is sometimes felt in the suprasternal region, and there is a band of dulness obtained along the left border of the sternum in the first, second and third interspaces. The bruit is best heard in the second interspace to the left of the sternum. It is said to be systolic in infancy, later acquiring also a diastolic quality.

The differential diagnosis is to be made from stenosis of the pulmonary artery.

REFERENCE

Goodman: Univ. Penna. Med. Bull., 1910–11, xxiii, 509.

A Case of Sprengel's Deformity

The literature of Sprengel's deformity has been so thoroughly studied by A. E. Horwitz, *American Journal of Orthopedic Surgery*, 1908, vi, 230, that it does not seem worth while to repeat it. Briefly, it is rather a failure of descent of the scapula than a high position. In the fetus the scapula occupies a high position and gradually descends, presumably as a result of the caudal pull of the muscles attached to it.

In nearly all cases of Sprengel's deformity the scapula is altered greatly in shape. The scapular index is changed and the superior border is curved. The scapular index is obtained by dividing the breadth measured along the base of the spine by the length measured from the inferior angles to the upper border and multiplied by 100. In Europeans it is from 63 to 65, and in the lower races and the apes it is much higher, reaching 100 per cent in gibbons.

In 25 per cent of the recorded cases there is a bony articulation between the spinal angle and the spine, usually with the lamina of the lower cervical vertebræ. It is frequently associated with defects in the ribs, vertebræ, muscles and occasionally alterations in the humerus and clavicle. Scoliosis is present in 47 per cent of all cases. It is, however, often found in persons otherwise practically normal, vigorous and capable, and doing hard work. Sprengel regarded it as due to the fact that the arm was bent backward and upward and compressed against the back of the fetus as a result of deficiency in the amniotic fluid. Rauger was the first to ascribe it to a failure of descent of the scapula. Horwitz believes that it may be due to increased intrauterine pressure, to the presence of an articulation holding the scapula to a certain vertebra, to various muscle defects, so that the caudal pull is not exerted, or for some reason the normal muscles are unable to exert their usual traction upon the lower and inferior

end. This is rather favored by the fact that the inferior angle of the scapula is, in the majority of cases, rotated outward and upward.

Drs. Fetterolf and Arnett, *American Journal of the Medical Sciences,* October, 1914, p. 921, have reported a case in which it was possible to make a careful dissection of the muscles. In this case a bony arch connected the angle of the scapula with an exostosis of the sixth cervical vertebra, the lamina of the fifth, sixth and seventh cervical vertebræ were not united with those on the other side, giving rise to spinal deficiency. This has been reported in other cases.

The patient was admitted to my service at the Philadelphia General Hospital suffering from a mild bronchitis. The deformity of the left shoulder was striking, but it did not incommode him in any way. The roentgenogram shows that the scapula is articulated with the spinal column, the less usual form. He left the hospital upon his recovery.

DISCUSSION

Dr. S. Solis-Cohen: The point in Dr. Sailer's paper which interests me most is the description of the murmurs in the case of patulous ductus arteriosus. It was my fortune recently to be able to exhibit a case of this abnormality to my class. The patient had been sent into the hospital with a suspicion of pulmonary stenosis, as is not unnatural in such cases. The clinical history, however, was clearly against that diagnosis. The child had not been a "blue baby," and characteristic function failures, cyanosis and the like were wanting. The principal clinical sign was a constant dyspnea aggravated by exertion. The murmur was extremely interesting and a little difficult to explain. The characteristic thrill was present, but the sounds were not such as Dr. Sailer has described or as the books commonly give. As a whole, they brought to my mind the description of the maelstrom in Schiller's "Diver"—or, rather, in Bulwer's translation of Schiller:

> "And it bubbles and seethes, and it hisses and roars,
> As when fire with water is commixed and contending."

This impression, as of a whirlpool with bubbles and columns of fluid, was brought about, I presume, by the mixture of the two streams from the right and the left heart in the pulmonary artery. Quite a loud blowing and whirring sound, systolic only, was also heard over the apex in the usual situation of mitral murmurs. It was not, however, transmitted into the axilla, although there was a faint sound in the back near the second and third dorsal vertebræ, and I was unable to decide whether this was a transmission from the apex or from the main sound in the pulmonary artery, or whether the apex sound was not itself merely a partial transmission of the basic murmur. The latter supposition seemed the most plausible in view of all the signs—rational as well as physical. No soundless area intervened between the apical and basal murmurs, and there was a gradual intensification from apex to base, with no abrupt change of quality, merely additions of bubbling and hissing sounds, without any modification of the blowing sound except in volume and loudness. Mitral lesions, however, do accompany patency of the duct at times, and I am content for the present, to leave the question—like the duct—open. The electrocardiogram was taken by Dr. Patterson, who confirmed the clinical diagnosis. It presented pretty much the same picture as that Dr. Sailer has shown and the *x*-ray presented about the same features.

Dr. Joseph Sailer: There is very little to say. Dr. Goodman reported some cases several years ago collected from the literature and confirmed by autopsy, and he concluded there were no pathognomonic signs of the condition. We must remember that the nature of the lesion is the same, but the degree of the lesion varies very greatly and the physical signs vary in degree with the lesion. Gibson's sign is fairly constant; it is an almost continuous bruit, and usually it is possible for the one auscultating to determine a systolic and diastolic phase. In one case, however, the variation in intensity of murmur was said to have borne no relation to the action of the heart, and I presume it was a murmur something of that kind that was heard by Dr. Cohen as a whirlpool sound with all sorts of sounds at irregular intervals. The most interesting feature in this case to me was the fact that we had here some of the vascular phenomena of aortic insufficiency without any insufficiency of the aortic valve, but these phenomena, of course, were produced by the discharge of the blood in the aorta into the pulmonary artery. This produced a Traube's sign but not a Duroziez's. It would be interesting to know why. Another point was the fact that there was a very large pulse pressure, and that this pulse pressure on the second occasion we took it corresponded to the suggestions I made regarding the effect of high pulse pressure—that is, the leg pressure was much higher than the arm pressure.

HEMATURIA AND APPENDICITIS[1]

By ASTLEY P. C. ASHHURST, M.D.
AND
L. G. WOODSON, Jr., M.D.
BIRMINGHAM, ALA.

It is a much less unusual experience for an attack of colic due to stones in the right ureter to be mistaken for an attack of acute appendicitis, and for the appendix to be mistakenly removed, than it is for an attack of appendicitis to be diagnosed as stone in the ureter and operation postponed. That there may be, sometimes, justification for the latter course, however, is apparent from the following case history, which is given as related by the patient himself:

L. G. W., Jr., male, aged twenty-six years, resident physician in the Episcopal Hospital, Philadelphia.

Family History. Father had renal colic in his early thirties and passed stones, but has had no trouble since. One brother, in 1904, died from tuberculous meningitis. One sister had thyroid removed two months ago. History otherwise excellent.

Personal History. Is said to have had a patulous foramen ovale for the first three months of life. His general health has been excellent. Had measles, pertussis, varicella and mumps in early childhood. No other illnesses until 1917, when his feet were frozen while snowshoeing in Canada. Developed a right basal pleurisy at this time. Was tapped and clear fluid obtained; thought to be tuberculous. Patient was in bed one month with

[1] Read October 4, 1922.

this condition, and at that time he dropped from 145 to 125 pounds in weight (65 to 56 kg.). Subsequent recovery was perfect. One year ago had neuralgia of the left side of face affecting the superior maxillary division of fifth nerve. Left antrum tapped at the time and irrigated with normal salt. No subsequent trouble.

Entered the Episcopal Hospital, Philadelphia, as resident physician in August, 1920, and at that time his weight was 145 pounds (65.75 kg.). Present weight 195 pounds (88.43 kg.). His appetite is excellent and bowels regular. Had had slight irritability of the bladder for the last two years, at times very evident, and accompanied by frequency of urination; and at other times the bladder symptoms would be entirely absent. Occasional attacks of indigestion, flatulence, heartburn, feeling of fulness in the epigastrium and belching of gas. The attacks are accompanied by very sour disposition. The attacks have been much less frequent since his gain in weight.

Uses tobacco moderately in the form of pipe-smoking. No Neisserian or luetic infection. Wassermann taken just before his present illness was negative.

Present Illness. Chief complaint is pain in the right side. On the morning of admission (April 26, 1922) had frequency of urination with slight burning, passing rather scanty amounts. Several hours later developed pain in the head of the penis and in the right testicle. He felt a constant desire to urinate even when the bladder was empty. The pain was not severe in character. Immediately after eating dinner, at 6.15 P.M., he had a copious bowel movement accompanied by great strain. At this time he had slight intermittent pains, lasting thirty seconds and occurring about once every minute. The pains were in the lower right side. The pains became perceptibly longer and more frequent, as well as more severe, when in the course of an hour the patient was unable to lie quietly in bed, tossing about from side to side with each paroxysm. By this time the pain was almost continuous. The pains were very severe in character and seemed to radiate from the lower right abdominal fossa downward and inward, at times extending to the head of the penis. Shortly after 7.30 P.M.

he vomited rather copiously and for five minutes felt relieved. A paroxysm of pain then again developed.

On admission, patient is a well-nourished white male, with a subnormal temperature, who is covered with a profuse cold and clammy sweat, and is very restless.

Head. Face, scalp and ears are negative. Mouth in good condition.

Chest. Expansion is good, lungs are clear and resonant throughout and no rales or adventitious sounds are heard. Heart sounds are clear and regular and no murmurs are heard.

Abdomen. No spasm of recti; no masses palpable; slight tenderness in the right kidney region; very slight, hardly perceptible tenderness in the lower right abdominal quadrant on deep pressure; no superficial tenderness.

Extremities negative.

Reflexes negative.

White blood cells, 9800.

Temperature. Subnormal.

Patient was given soapsuds enema as soon as admitted. Very restless at this time and had difficulty in lying still. Pains seemed augmented immediately after enema, but five minutes later the pain stopped with great suddenness. Specimen of urine obtained at this time and sent to the laboratory proved to be loaded with red blood cells. He was seen by Dr. Ashhurst at 9.30 P.M. Local examination was entirely negative excepting for tenderness on deep pressure low down in the right iliac fossa. Rectal examination was negative. On account of slightly subnormal temperature, normal white blood cell count, blood in urine and sudden cessation of pain a diagnosis of stone in the right ureter was made.

April 27, 1922. Passed a good night, but at 10 A.M. developed an attack entirely similar to the above. Given morphin sulphate (grain $\frac{1}{4}$) and atropin (grain $\frac{1}{100}$) at 10.30 A.M. Symptoms abated shortly afterward. Roentgen rays of the right kidney and ureter regions show two shadows in the clear space of the sacroiliac joint just below the pelvic brim, resembling ureteral calculi (Fig. 1). Urine shows blood in microscopic amounts.

April 28, 1922. Slight pain in the right side. Not very tender. Nauseated at times. Roentgen-ray examination today fails to

FIG. 1.—Roentgen ray of pelvis showing two shadows in sacroiliac notch, resembling stones in ureter.

show shadows characteristic of calculi in region of ureter or bladder. There is still microscopic blood in the urine.

April 30, 1922. No pain; up and about.

May 1, 1922. Discharged in good condition.

The intern was readmitted as a patient May 7, 1922, complaining of pain in the right side. He had gone down to a town in New Jersey, May 5, 1922, to spend a week-end. May 6, 1922, he had a hearty midday meal; at 5 P.M. the same afternoon he had very slight pain in the lower right abdominal quadrant. He hesitated to speak of this, so he ate his evening meal at 6 P.M., after which the pain became very much more severe and shifted to the epigastrium. Bowels moved freely and the pain became so severe that he had to lie down. Shortly after 7 P.M. the patient vomited slightly with a feeling of relief, but in ten minutes the pain returned and in twenty minutes he vomited again quite profusely. About 1 dram of bright red blood was vomited in the first retching before the second vomiting spell. The pain was continuous throughout the night and interrupted every now and then by vomiting spells. The pain was somewhat relieved by the application of heat in the form of an electric pad. Throughout the evening of the attack there was no rigidity of either rectus, the pain was entirely epigastric and steady in character and there was no tenderness in the lower right abdominal quadrant. The epigastric pain was accompanied by a decided feeling of fulness in the same region. There was no radiation of the pain to the right testicle or to the head of the penis, and no frequency of urination. The temperature was not taken. By morning, May 7, 1922, the pain shifted to the lower right abdominal quadrant, and there was distinct tenderness over McBurney's point with slight spasm of the right rectus. The pain was now of a dull, aching character. Patient returned to Philadelphia and was admitted to the Episcopal Hospital and operated on at 12 noon, May 7.

May 7, 1922. "The patient says this attack is entirely different in character from the former, in which the diagnosis was ureteral calculus. The slight fever, the leukocytosis and the local signs indicate acute appendicitis. Now has no pain referred to the genitourinary tract." (A. P. C. A.)

Operation. Appendectomy. Gas (and ether, 40 cc).

Transverse incision, 10 cm. Cecum prolapses upon opening the peritoneum. Appendix adherent in right lumbar region, lateral to ascending colon. Tip gangrenous. Mesoappendix ligated in sections, stump crushed, ligated and buried. No stones palpable in ureter at or below brim of pelvis. Wound closed in layers without drainage. Silkworm gut for skin.

Appendix contains two coproliths and fecal pus under tension.

Laboratory Report. Acute suppurative appendicitis in a chronic fibroid appendix. (Dr. C. Y. White.)

May 8. Urine shows no blood.

May 9. Postoperative condition is fair. Slight nausea. Severe pain at night with tenderness in the right testicle. Practically no sleep at night. Patient is rolling and tossing with severe pain, beginning each night about 10 P.M. and lasting until morning. Urine shows no blood.

May 11. Complains of pain, paroxysmal in type and radiating down the right testicle. Temperature slightly elevated.

May 12. No sleep since the operation. 9 P.M. was given codein (grain 1) by hypodermic. 10.30 P.M. repeated; no sleep. 1 A.M. was given $\frac{1}{4}$ grain of morphin sulphate by hypodermic.

May 13. Slept after 2 P.M. Slept nearly all day. No pain. Urine shows microscopic amounts of blood.

May 14. Fine night; no pain.

May 15. Stitches removed. Fat and serum drains from outer end of the incision. Temperature down to normal.

May 18. Condition is good; is able to sit up.

May 19. Walking a little; no blood in urine.

May 20. Condition good; complains of slight discharge of fat and serum from lateral end of incision. Transferred to the resident physician's quarters from private floor.

June 9, 1922. Cystoscopic examination by Dr. Pelouze shows no stones in the bladder or right ureter. Catheter passed with ease to the right kidney. Low-grade cystitis present. Patient is not aware of having passed any stones at any time.

October, 1922. Has had no further abdominal or urinary symptoms.

The attack of April 26 certainly was sufficiently characteristic of ureteral colic to justify the clinical diagnosis. There was the colicky character of the pain, its reference to the genitourinary tract, the premonitory vesical tenesmus and the very sudden cessation of pain at the conclusion of the attack; there was the absence of fever and leukocytosis and only negligible tenderness even on deep pressure over the right iliac fossa. Added to these clinical facts there was the confirmation derived from the finding of blood in the urine and shadows resembling calculi in the pelvic portion of the ureter as shown by the roentgen rays.

Fig. 2.—Roentgen ray of concretions found in appendix.

The fact that a subsequent roentgen-ray examination, two days after the acute attack, failed to show the same shadows was believed to indicate that the calculi had passed into the bladder, where they were not easily detected. It was intended to have a cystoscopic examination made as soon as convalescence was established, but the sudden onset of the typical attack of appendicitis necessitated its further postponement. It is probable that the shadows mistaken for two ureteral calculi were caused by the coproliths in the appendix,[1] though at operation (May 7), ten

[1] These cast skiagraphic shadows (Fig. 2).

days after the roentgen rays were made (April 27) the appendix was found adherent in the right lumbar region on the lateral side of the ascending colon and not hanging over the brim of the pelvis where the skiagraphic shadows were seen. But if the appendix was not adherent to the ureter below the pelvic brim at the time of the first attack it is difficult to account for the hematuria and referred pain; and if it was adherent even then in the right lumbar region, where found at operation, it is difficult to believe that it would not have caused a repetition of the genitourinary symptoms during the second attack, if being adherent in that situation had caused them during the first attack. However, there seems no good reason to think that the patient ever did have ureteral calculi, as none were ever passed, and the skilful examinations of Dr. Pelouze showed none were present in the bladder or ureter.

The following somewhat similar case was recently reported by von der Beck:[1]

Female, aged forty-eight years, emaciated and anemic. Had had colics in right abdomen for three or four years; then in February, 1921, developed dysuria and frequency; urine cloudy and very bloody. Kidneys both palpable; tenderness beneath right costal margin. Cystoscopy showed bladder mucosa inflamed and slight ulceration around right ureteral opening. Normal color test for left kidney, much less than normal on right. Ureteral catheter gave normal urine from left, bloody and purulent urine from right. Roentgen rays showed three shadows in right kidney region, taken for calculi. Diagnosis: Pyonephrosis right, with calculi. Operation, April 14, 1921. Right nephrectomy, kidney appearing practically normal at operation. Recovered and did well for one week. Then recurrence of symptoms, fever and palpable tumor size of child's fist in gall-bladder region. Thinking it was phlegmon from stump of ureter, kidney wound was reopened, but nothing abnormal found. (Pathological examination of kidney showed no lesions of note.) Fever and tumor in gall-bladder

[1] Ztschr. f. Urologie, 1922, xvi, 50.

region continued. The shadows taken for kidney stones might be gallstones. Fifty-two days after nephrectomy abdomen was opened over gall-bladder, which was buried in adhesions, but found normal; but on its under side the appendix was found running directly behind the right lobe of liver. It was removed. Very long and chronically inflamed.

Casper remarked, in the discussion which followed the presentation of the above-quoted case that if there is only blood in the urine the diagnosis between appendicitis and ureteral or renal calculus is difficult; if pus as well as blood comes from the right ureter the renal affection is the true diagnosis: but the urine from the right ureter in von der Beck's patient was reported as purulent, so even this sign may prove unreliable.

In the present state of our knowledge we can only speculate as to the method by which disease of the appendix may cause hematuria: Is it from direct irritation of the kidney or ureter by an adherent inflamed appendix, or is it possibly the result of toxins carried by the blood and excreted by the kidney? The former seems the more likely way, at least in those cases in which the urine from the left kidney has been shown to be normal.

THE ACIDOSIS OF ETHER ANESTHESIA[1]

By J. HAROLD AUSTIN, M.D.
AND
GLENN E. CULEN, Ph. D.

The possibility that ether anesthesia is associated with some degree of acidosis is a view that has been under discussion and investigation in recent years. Crile and Menten, in 1915, reported an increased H-ion concentration of the blood in rabbits during anesthesia. Caldwell and Cleveland and Jonas and Austin found a consistent fall in the plasma bicarbonate, *i. e.*, in the CO_2 combining capacity of the plasma, as a result of ether anesthesia in operated patients. Morris found a similar fall in the plasma bicarbonate after operation in gynecologic patients and found that this fall was diminished if sodium bicarbonate was given intravenously before operation. In dogs he obtained a fall after chloroform anesthesia as well as after ether anesthesia.

All of these observers interpreted the fall of plasma bicarbonate as an evidence of acidosis.

Yandell Henderson, from experiments on dogs, observed the fall in blood bicarbonate during anesthesia, but arrived at a different conclusion as to its significance. Henderson concluded that the fall in bicarbonate was not the result of the formation of acid. He believed that it was compensatory to a decrease in hydrogen-ion concentration, which in turn was the result of stimulation of the respiratory center by ether, with a pumping off of CO_2.

The H-ion concentration in Henderson's experiments was estimated indirectly by calculation from the bicarbonate content

[1] Read October 4, 1922.

of the blood as drawn and when saturated with known tensions of CO_2. Such *calculation* of the H-ion concentration, however, involves assumptions the validity of which has only been established under limited conditions. Collip, in 1920, attempted a similar *calculation* of H-ion concentration during anesthesia. He found the method not entirely satisfactory, but indicative, he believed, of an *increased* H-ion concentration of the blood developed during anesthesia.

Van Slyke, Cullen and Austin[1] attempted to reach some conclusion as between these divergent explanations of the fall in blood bicarbonate, substituting for the indirect method of *calculating* the H-ion concentration, its direct determination. Our studies were made upon dogs and the H-ion concentration of the serum was determined either by the standard gas-chain method with Clark electrodes or by a colorimetric method recently devised by Cullen, and especially applicable for such a study. The results of a few typical experiments are shown in the diagram. In all experiments it will be seen that the H-ion concentration of the blood increased either at once or in a short time after the anesthesia was begun, and in the last three experiments it will be seen that although the H-ion concentration remains high and continues to rise, the blood bicarbonate continues to fall. In no case was any fall of H-ion concentration below the initial value observed. In all but one of the experiments the CO_2 tension was increased.

Atkinson and Ets[2] published, last spring, a similar study on etherized dogs, using another direct colorimetric method for the H-ion concentration of the serum, devised by Dale and Evans. They arrived also at the conclusion that there is an increase in the H-ion concentration after anesthesia.

The evidence from these direct measurements of the H-ion concentration is more reliable than that obtained by calculation from the CO_2 content and capacity of the blood or serum. It may

[1] The Effect of Ether Anesthesia on the Acid-base Balance of the Blood: Jour. Biol. Chem., 1922, liii, 277.

[2] Chemical Changes of Blood under the Influence of Drugs, Jour. Biol. Chem., 1922, lii, 5.

therefore be considered demonstrated that there is developed during the ether anesthesia a true acidosis with increase in the H-ion concentration in the blood and with fall in the bicarbonate content of the blood. This must be due either to introduction of acid (other than CO_2) into the blood or to a primary (and not merely compensatory) withdrawal of base from it.

In connection with this subject, however, one may emphasize the existence of three more or less distinct problems. The first is the one we have been discussing: Whether a true acidosis develops during anesthesia or whether the reduction of bicarbonate is compensatory to an alkalosis. Our view concerning this problem with respect to ether anesthesia we have just stated.

The second problem concerns the time relations of this acidosis to the course of the anesthesia, its cause and whether the degree of increase in the H-ion concentration which occurs is to be considered detrimental to the subject or whether it has, on the other hand, some compensatory importance. This is a large problem and few data are available as yet for its answer.

The third problem concerns the therapeutic value of rebreathing or of inhalation of mixtures containing an increased content of CO_2. There are a number of effects brought about by change of CO_2 tension in addition to the change in blood reaction and bicarbonate content. An increase of CO_2 tension in the blood and tissues, for example, affects the affinity of hemoglobin for oxygen, giving a steeper curve at atmospheric O_2 tension, and this tends to increase the oxygen tension in the tissues. Henderson found that high CO_2 tension also tends to induce locally an increase of blood flow. It is possible that rebreathing or inhalation of CO_2 may be of value to the patient through its influence on O_2 tension or blood flow, even though acidosis exists and even though increasing the CO_2 tension increases still further the H-ion concentration in the blood. Observations on the apparent beneficial effects of CO_2 inhalation in carbon monoxide poisoning and Yandell Henderson's observations of apparent beneficial effects of CO_2 inhalations during and after anesthesia suggest this possibility. The investigation of this possibility constitutes, therefore, a separate problem.

DISCUSSION

Dr. Hobart A. Hare: I appreciate the fact that in rising to speak on this paper one shows some temerity, because it is essentially technical and deals with facts that are not familiar to many Fellows of the College. I am not competent to discuss the technical points which have been advanced so well by Dr. Austin and Dr. Cullen. I think, however, that they will agree with me that the use of this word "acidosis," no matter how accurate it may be from the standpoint of themselves and their fellow-workers, has done some damage, because many of the profession think that it means increased acidity of the blood, which should be neutralized with alkali, with the result that they drench the patient with bicarbonate of soda and thus do harm. From a practical standpoint I should like to ask Dr. Austin whether the return of the condition, of what is correctly called by scientific investigators "acidosis," to normal is not fairly prompt—so prompt, for example, that there is no necessity for the clinician to administer alkalies with the idea of benefiting the patient who has been under the influence of ether. I have nothing but clinical data to support my view, but my feeling would be that probably the restoration of normal acidity or hydrogen-ion concentration occurs within such a short time after the administration of ether that the administration of bicarbonate of soda is needless and sometimes harmful.

Dr. George B. Wood: I had much preferred to sit still and listen to the very scientific and clear presentation on ether acidosis by Dr. Austin, but Dr. Hare's question, as to whether the giving of sodium bicarbonate after anesthesia is imperious or not, brings up the clinical side, and in this relation I want just to make a brief statement. A part of the technic of our tonsil operations at the Howard Hospital has for the past three or four years included the administration of preoperative doses of sodium bicarbonate sufficient to render the urine alkaline. Since adopting the routine use of sodium bicarbonate, postoperative vomiting has been reduced 75 per cent. Further, if there is vomiting following the operation, which is not due to hemorrhage, the administration of sodium bicarbonate by mouth, in the large majority of cases, gives complete relief. I have never seen any evidence of an alkalosis or other injurious result from its administration.

Dr. J. Harold Austin: In reply to Dr. Hare, I would say that I quite agree with him as to the difficulty caused by the use of the term acidosis. The varied meanings which this term may have are best brought

out, perhaps, by the diagram used by Van Slyke in discussing the "Carbon Dioxide Carriers of the Blood." There are nine different areas represented in this diagram, of which one is normal and the other eight are abnormal. Each area represents a different type of disturbance of the acid-base equilibrium, yet three of these areas are commonly designated as acidosis and two others are sometimes so described. The term is certainly too ill-defined and must always be accompanied by further information to indicate the exact condition.

With regard to the restoration of acid-base equilibrium to normal after post-anesthetic acidosis, the hydrogen-ion concentration of the blood comes back very rapidly to normal as soon as the respiratory mechanism escapes from the narcotic effect of the anesthetic. Restoration of the alkaline reserve of the blood to normal is a much slower process and may take a day or two. The giving of sodium bicarbonate before operation diminishes the drop in the alkaline reserve. One may assume that this would be beneficial to the patient; positive evidence as to this latter point can best be obtained from just such observations as those mentioned by Dr. Wood.

THE VALUE OF SECTIONS OF THE BODY IN TEACHING APPLIED ANATOMY[1]

By CHARLES W. BONNEY, M.D.

In 1914, some months after the death of Professor George McClellan, the course in applied anatomy given to third-year students at Jefferson Medical College was reorganized. Professor Schaeffer, who was appointed director of the Daniel Baugh Institute of Anatomy in that year, suggested that instruction be instituted in sectional anatomy, and after due consideration it was decided that a course in that subject should be given to third-year students in connection with the lectures and demonstrations in applied anatomy. Through the munificence of Mr. Daniel Baugh, a well-equipped laboratory was provided.

As the work of preparing sections from frozen formalin-injected bodies went on, it became apparent that the material thus acquired would be useful in illustrating many anatomical facts having a direct bearing upon the practice of surgery and medicine. After an experience of eight years we believe that the method has proved of sufficient worth to warrant its presentation to the Fellows of the College.

Concerning preparation of the material, it will suffice to state that the sections are cut by means of an electrically-propelled band-saw, and that they are made from specially selected cadavers which have been injected with a strong solution of formalin and then thoroughly frozen in the refrigerating vault.

I have brought with me eight or ten slides prepared from repre-

[1] Read October 4, 1922.

sentative sections which I think will make our method of teaching much clearer than any didactic description could make it. (Lantern demonstration was begun.)

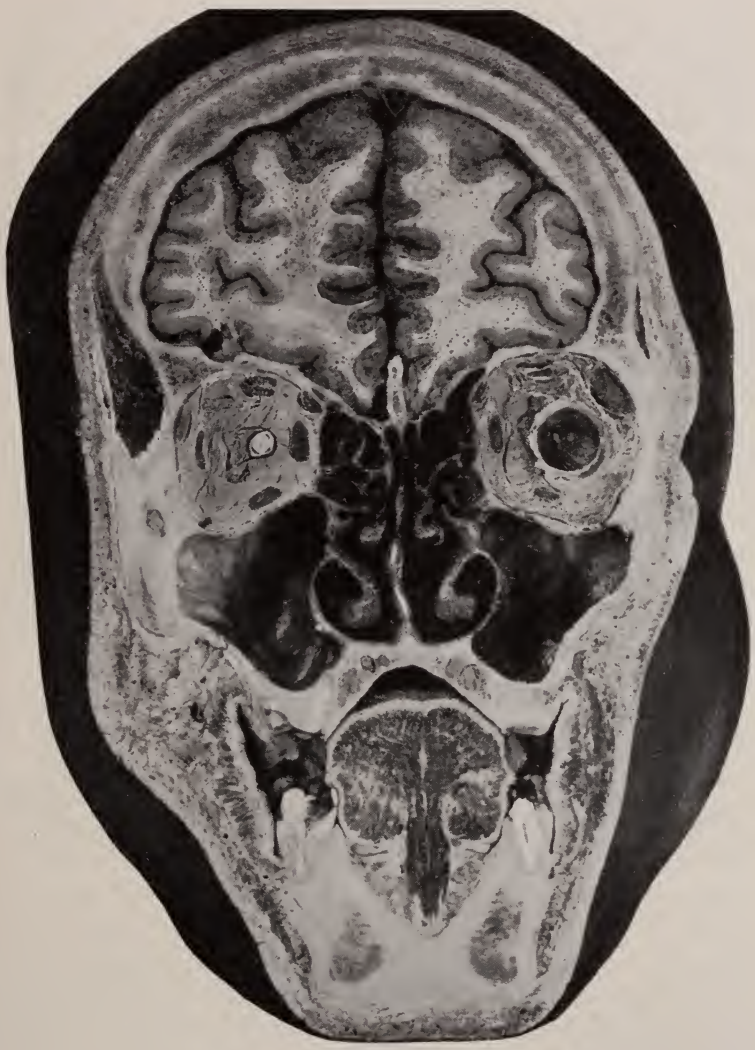

Fig. 1.—Coronal section through the front of the skull.

This is a coronal section through the front of the skull, somewhat anterior to the vertex, straight down through the face (Fig. 1). When the student studies this section, the relations of the maxillary sinuses to the nasal chambers are shown to him, and it is pointed out how the rhinologist drains the sinus by pushing an angulated knife through the lateral wall of the inferior meatus underneath the inferior concha. The pathway of infection through the sockets of certain teeth is also demonstrable in this specimen. The method of draining the sinus by drilling through the socket of a tooth is explained when the parts are studied. Superiorly the relation of the sinus to the orbit is well shown. In this connection the student's attention is called to the thinness of the bone separating the two cavities, and he is told how a sarcoma of the orbit can easily invade the sinus.

The second section is cut sagitally, though not through the vertex of the skull, the saw having been carried a little lateral to the midline. Here the sphenoidal sinus is shown very nicely with some of the ethmoid cells in front of it. When demonstrating this section, occasion is taken to show the close relation between the roof of the sphenoidal sinus and the brain. This relation explains those cases, fortunately rare, in which a patient has an operation performed upon the sphenoidal sinus, perhaps in a doctor's office, under local anesthesia, and then within a few days develops a fatal septic meningitis.

The third slide was made from a transverse section through the ethmoidal and sphenoidal sinuses (Fig 3).

The fourth section has probably been cut at a slant. On one side the mastoid cells are plainly seen, on the other only a few of them appear. Observe the relation of these air-spaces in the bone to the lateral venous sinus. This is another important matter to which the student's attention is called, and he is taught how to keep away from the sinus when trephining the mastoid process. The pathogenesis of sinus thrombosis, in so far as it is dependent upon structural relations, is explained to him as he works with such sections as this one.

The fifth section is used to illustrate the anatomical basis of cer-

tain symptoms of aneurysm of the aorta (Fig. 5). The arch and the ascending and descending portions are shown. Here, to the right of the aorta, is the superior vena cava, a little posterior the trachea

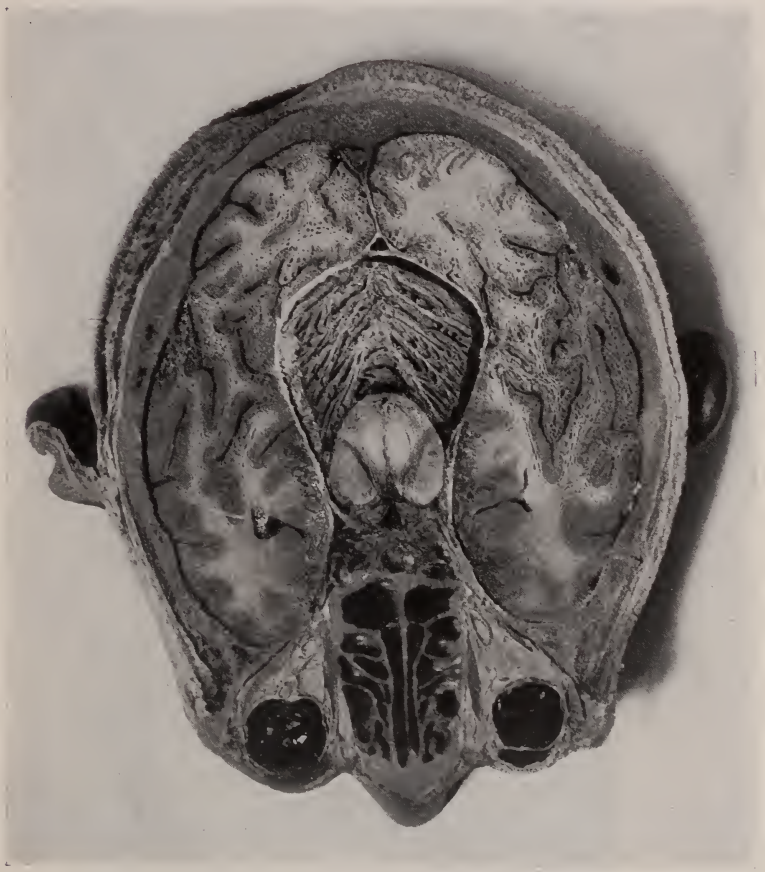

Fig. 3.—Transverse horizontal section through the ethmoidal and sphenoidal sinuses.

and still farther back the esophagus. The manner in which a dilatation of the ascending portion of the aorta will impinge upon the vena cava and thus bring about interference with the venous circulation is explained. The respiratory disturbance caused by

pressure of an aneurysmal sac situated farther back in the arch is also considered, as well as the dysphagia due to pressure upon

FIG. 5.—Transverse section through the thorax showing the aorta and important structures in relation with it.

the esophagus when the dilatation involves the third part of the aorta. The recurrent laryngeal nerve is not plainly seen in this picture. It would be easy to tease it away from the surrounding

tissues with fine forceps or needles, or even with the fingers. This is done as the student works on the section, and it is explained to

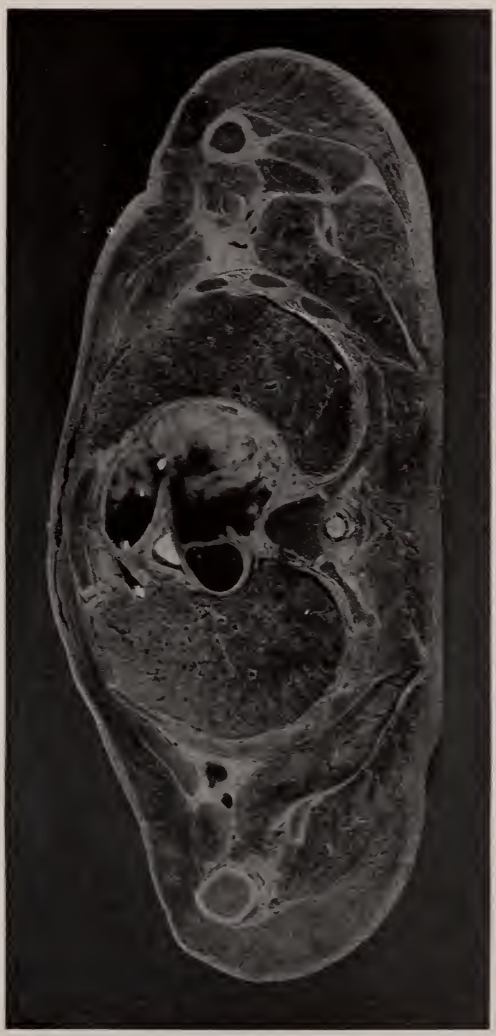

FIG. 6.—Transverse section through the thorax showing rupture of an aneurysm of the aorta.

him how pressure upon the nerve causes the harsh, nonproductive cough, the so-called "brassy cough," with which some patients having aneurysm are affected. This section is one of the most

valuable ones we have for showing how certain clinical symptoms are dependent upon anatomical relations.

FIG. 8.—Transverse section through the pelvis, showing the prostate gland and the rectum.

The next slide, No. 6, shows rupture of an aneurysm through the arch of the aorta (Fig. 6).

No. 7 is a section cut from the same body just a little lower down, and shows how the blood passed from the great arterial trunk into the esophagus and thence down into the stomach.

FIG. 9.—Transverse section through the pelvis, showing bladder seminal vesicles and rectum.

This section, No. 8, was cut through the pelvis. It shows the prostate, rectum and some of the bones of the pelvis together with the muscles attached to them (Fig. 8). When going over this section

with students, I have taken special pleasure in showing them the periprostatic plexus of veins, which is situated outside the capsule of the gland, and impressing upon them how necessary it is when performing prostatectomy to keep the enucleating finger within the capsule of the gland. If the enucleation is attempted in the space outside the true capsule, severe hemorrhage will occur. In

Fig. 11.—Transverse sections through the lower extremity.

the earlier days of prostatectomy many accidents, and even fatalities, resulted from failure to make a correct anatomical enucleation. In drawing this section the gluteal muscles shown here are included in the sketch and also those structures appearing in the anterior region of the section.

In the next, No. 9, the bladder is shown in front and the rectum

behind. Lying between them on each side is a piece of seminal vesicle (Fig. 9). The principal lesson in pathology here relates to that interesting organism, the gonococcus, which so frequently invades the vesicles and gives rise to so much and to such long-abiding trouble. The remote position of the vesicles and the circumstance that they are made up of separate compartments, as shown beautifully in cross-section, are matters which are fully dwelt upon as the section is studied. This picture shows considerable thickening of the bladder wall, the probable pathogenesis of which might be explained to a student who was studying the specimen. In front are the great bloodvessels descending from the pelvis to supply the anterior region of the thigh.

No. 10 is of pathological as well as anatomical value. The man from whose body it was taken died of empyema. Here is an adhesion between the lung and chest wall. This specimen also shows how the potential pleural space is converted into an actual cavity by disease. Note the contraction of the lung.

The next slide, No. 11, shows transverse sections through the lower extremity.

Now a few words as to the manner in which the student works with these sections. He first lays a plate of glass over the surface to be drawn and traces an outline of the important parts with a wax pencil. Then he puts a sheet of drawing paper over the glass, and by means of light reflected from an electric bulb, under a glass table, he is enabled to transfer his tracing from the glass to the paper, using for that purpose an ordinary lead-pencil. Returning to the specimen with the tracing thus made, he fills it in with certain colors, according to a scheme devised by Dr. De Carlo. The parts are labelled by means of lines leading from them to the margin of the paper beyond the drawing. We have always taught that structure and function are interdependent and inseparable, and, furthermore, that deviations from normal function depend largely upon the structure of the organs or tissues involved. Thus anatomy, physiology and pathology are closely correlated in our course of instruction.[1]

[1] Owing to the lack of space, several of the sections shown had to be omitted from the Transactions.

AN ANALYSIS OF RADIATION THERAPY IN CANCER[1]

The Mütter Lecture

By JAMES EWING, M.D.
PATHOLOGIST TO THE MEMORIAL HOSPITAL, NEW YORK

Only two definite epochs appear in the history of cancer therapy. One began with the Ancients and continued, practically unchanged in its conception, until about the beginning of the twentieth century. Its principle consisted in the complete removal of all cancer tissue, and for this purpose reliance has been mainly on the knife. From time to time the cautery, in one form or another, has contested the sway of the knife, but in spite of certain apparent advantages, it is probably not more popular today than it was in some previous centuries. A more consistent rival of the knife has been, from the earliest times, the caustic chemical, which today enjoys rather cool approval, but, nevertheless, maintains itself in isolated circles as a worthy agent. All of these methods aimed to accomplish the one object which alone was demanded according to prevailing theories of the nature of cancer, the direct removal from the body of the offending cancer cell.

Probably no other medical problem has through the ages received such searching attention or such skilful elaboration. As for the results, and the capacity of this therapeutic method to cope with cancer, few will deny that the verdict is "unsatisfactory." The mortality from cancer, as judged from statistics, has been but

[1] Read November 1, 1922.

slightly influenced, while from the narrower viewpoint, that of the cancer patient, the same verdict must be returned. Nor does it seem likely that any improvements in surgical technic, nor any fruits of the misconceived search for a supposed cause of cancer, will alter this conclusion, while the campaign for the early recognition of cancer offers hope in only a limited field. Established cancer will long remain the chief form of the disease.

About the beginning of this century a new era slowly began in the treatment of cancer. In the course of a decade it was discovered that *x*-rays and radium exert a somewhat selective effect on proliferating tissue cells, and especially on tumor cells, and in the course of another decade the methods of treating cancer by these physical agents have experienced a very extensive development, in connection with which an entirely new branch of scientific research and practical therapeutics has grown up. Are the bases of this new science secure?

The final answer to this question will probably be found to depend on the validity of the theory of the selective action of the gamma rays, for if it transpires that radium and *x*-rays are merely new and handy destructive agents or caustics, then the startling regressions and apparent cures of many cancers which inflame the enthusiasm of radiotherapeutists will be succeeded by an increasing proportion of late recurrences, the difficulties, dangers and sequelæ of radiotherapy will claim increasing attention, and radiotherapy will subside into a subordinate place in the treatment of cancer.

It also appears highly probable that unless radiotherapy conserves the natural resistance of the body against cancer, and fortifies its mechanism, even unless it increases the natural resistance and works *secundum Naturam,* in accordance with the physiological significance of the cancer process, it is destined to enjoy only a temporary popularity and will sooner or later take its place with the other empirical methods, such as surgical extirpation.

Do radium and *x*-rays exert a selective action on tumor cells? Bearing on this matter, there is first considerable clinical evidence. When a proper dose of filtered radiation is applied over a basal-

cell carcinoma in the skin, this lesion has in many instances slowly disappeared, leaving little or no scar and not recurring after many years. Similar effects have repeatedly been observed after similar treatment of many examples of the entire group of basal-cell carcinomas, so that this group early became recognized as peculiarly susceptible to radiation. Similarly, lymphoid tumors, without apparently any exceptions, melt rapidly under adequate radiation, although secondary changes such as fibrosis may render such growths refractory. This rule also applies to a considerable variety of tumors related to the lymphoid group, such as endothelioma of lymph nodes, endothelioma of bone and myeloma. In general, tumors derived from embryonal cells and retaining embryonal characters, even when growing rapidly, are, as a rule, particularly susceptible to radiation, and in this group some of the most remarkable and paradoxical of the radium cures have been recorded. Finally, it was early observed that very cellular rapidly growing tumors of any type, even when derived from adult cells, are often very susceptible to radiation, although the rapid extension of such tumors rendered the prognosis poor.

On the other hand, malignant tumors derived from adult cells and reproducing adult cells, such as squamous carcinoma, neurosarcoma, osteosarcoma, many adenomas and other benign tumors, prove very resistant or quite refractory to radiation.

From all these clinical observations, which were quite new in medical experience, the conclusion was naturally drawn that radiation has a selective effect on some but not on all tumors. From them was formulated the first law of radiation therapy, commonly known as the law of Bergonié and Tribondeau, which may now be broadly stated as follows: Tumors composed of rapidly multiplying cells, especially those of embryonal type, and particularly those of the lymphoid group, are highly susceptible to radiation, and in such ratio as the above characters are developed.

Although there are many factors which enter into susceptibility to radiation, clinical experience has now extended sufficiently to permit one to classify tumors according to their radiosensibility.

Relative radiosensibility of tumors:

1. Lymphoma: Lymphocytoma; lymphosarcoma; myeloma.

2. Embryonal tumors: Carcinoma of the testis and ovary; basal-cell carcinoma.

3. Cellular anaplastic adult tumors: "Round-cell" carcinoma; diffuse carcinoma.

4. Desmoplastic tumors: Carcinoma simplex; fibrocarcinoma; squamous carcinoma.

5. Adenocarcinoma: Adenoma of the uterus, intestine, breast, etc.

6. Fibroblastic sarcoma: Osteosarcoma; neurosarcoma.

The clinical observations on the high susceptibility of certain tumors did not, however, prove the selective action of radiation. This is a problem for more refined methods of study which have not yet provided a final solution.

The microscopical changes that follow the application of radium to a susceptible tumor strongly support the theory of a selective action. These changes have been described by so many observers, and are so well known, that it is unnecessary to review them in detail. They consist of swelling, hyperchromatism, vacuolar degeneration and solution or fragmentation of nuclei, hydropic swelling, vacuolation and solution of the cytoplasm. Mitotic nuclei are particularly vulnerable, the chromosomes splitting, the spindle threads disintegrating and the whole cell undergoing relatively speedy solution. The surrounding stroma exhibits hyperemia, slight serous exudation, outwandering of leukocytes and growth of new capillaries which in many instances probably plays a prominent part in the removal of tumor cells. The stroma cells may exhibit to a slight degree the same changes as the tumor cells, but it seems clear that the action on the stroma cells, in this the ideal form of radium reaction, is mainly stimulative and not destructive. Ideal radium therapy seems to require a nice adjustment of relations between destructive effect on tumor cells and stimulation of stroma cells. Opinions differ as to whether the action is mainly on the nucleus or on the cytoplasm, but it undoubtedly affects both, and probably in variable degree. The whole process seems to represent a peculiar form of autolytic

degeneration. By what physical and chemical processes the changes are brought about we do not know. The chemistry of radiated tumors has not been determined. There is reason to believe that cell constituents are ionized and intracellular ferments activated, so that reactions readily occur which otherwise would not occur at all. It is obvious that this theory, if correct, definitely supports the view that the reaction to radiation is specific.

Whatever its nature, I find no reason for altering the conclusion expressed in 1916 that the series of changes occurring under these and in more severe forms of radium reaction, taken as a whole, are not duplicated under any other conditions and indicate a specific and selective action of radium upon tumor cells. Very similar changes are produced by *x*-rays, but I have drawn the impression that *x*-rays, as usually employed, are less selective in their effects and tend to produce more destruction of stroma and bloodvessels. If the above observations are correctly interpreted then radium therapy fulfils one of the requirements of a rational therapy, acting *secundum Naturam*. Under certain conditions here designated as ideal radium therapy, it exerts a selective action on certain tumor cells and causes their disappearance by autolysis.

But it soon became apparent that most tumors cannot be made to disappear by moderate external radiation which fails to destroy the overlying skin or mucous membrane and the surrounding stroma. Squamous carcinoma, one of the main goals of radium therapy, has notoriously resisted external radiation. It may recede, but it generally recurs after repeated external raying, and it was not until an essentially different and much more intense action was employed that any definite success was achieved in the treatment of squamous cancer. This method consists in employing radium as a caustic.

Apparently it was Stevenson, of Dublin, who about 1915 first inserted coarse needles containing radium into the substance of squamous carcinomas of the mouth and of the tonsil and leaving them there long enough to cause sloughing of the tumor. He thus succeeded in curing some of these cases. About the

same time Weil and Janeway employed the same method at the Memorial Hospital. Duane improved the method by using small amounts of emanation in capillary glass needles and leaving them in the persisting edges of rodent ulcer. To Janeway belongs the credit of perfecting the method and employing it on a large scale with squamous carcinomas of tongue, tonsil and many other tumors.

Lingual, buccal and tonsillar cancer, uncontrollable by other methods, yielded in a high proportion of cases to this procedure. Finally, Quick pursued the plan still further by inserting the needles into infected lymph nodes, where they remained permanently, becoming surrounded by dead tumor tissue and thickened capsules. This method has greatly extended the scope of successful radium therapy and is applicable to a wide variety of resistant tumors. The danger of disseminating viable tumor cells by the insertion of the needles is reduced by a preliminary surface radiation. The pain is considerable, but less than that which follows strong surface radiation of the mucous membranes.

The caustic action of radium may also be secured by the interstitial injection of radioactive deposit in salt solution. The solution diffuses over a rather wide territory, but is limited by the capsules of glands and tumors. It exerts a slow necrotizing action, followed by considerable cellular exudation, but without constitutional disturbance. It permits the full action of all the rays of radium, alpha, beta and gamma, and is thus much more powerful than any form of filtered radium. It is applicable especially to encapsulated tumors or encapsulated organs, particularly the lymph nodes. It has been employed as an intravenous injection in leukemia and lymphosarcoma. The method has many peculiar advantages and deserves more attention than it has yet received.

Regaud, of Paris, hesitates to adopt the caustic method, because, as he says, it is not true radium therapy, but he acknowledges failure to cure lingual cancer by other means. Each radium needle containing 1 mc. of emanation produces a zone of necrosis about 0.5 cm. wide, but a sterilizing action extends at least 1 cm. wide.

Each tube of 1 mc. of emanation yields the equivalent of 133 mc. hours of radiation in the course of its life. After fifteen days it reaches 1 per cent of its original strength, from which point further decay is slow. When fifteen to twenty tubes are employed the total amount of gamma radiation is considerable. It is probably this gamma radiation, sterilizing a wide territory, which is responsible for the clinical success and which renders radium the best caustic ever devised for cancer. Regaud's objection is thus partially met.

It is highly important to recognize that radiation therapy is no longer confined to the original simple autolytic process which controls many embryonal tumors, that it confesses failure to deal with many more resistant tumors by this method and resorts to the caustic action, markedly exhibited by the alpha and beta rays, in dealing with many forms of cancer.

The structural changes following the caustic action of radium support the view that this reaction is specific. This method has long been used in the treatment of cervical uterine carcinoma by placing radium tubes in the uterine canal until ulceration and necrosis follow. Here the cellular reaction is striking and peculiar. The tumor cells undergo extreme changes of the type previously described. They eventually undergo solution or form giant cells and syncytial masses in which polynuclear leukocytes penetrate and complete the absorption. Often structures strongly resembling miliary tubercles are produced. There is a very notable exudation of plasma cells which completely replace the eroded mucosa, while lymphocytes, large and small, are often present in the exudate. The small bloodvessels immediately beneath the eroded mucosa and about the foci of degenerating tumor cells proliferate and seem to actively excavate the nests of degenerating cells. Deeper bloodvessels undergo obliterating arteritis, which shuts down the blood supply and eventually produces general shrinkage of the tissues. This type of reaction I have not seen duplicated under any other conditions.

In dealing with basal-cell carcinoma of the skin and with squamous carcinoma of accessible mucous membrane, the procedures

above described have been found to yield such uniform results that the treatment of these diseases may be said to have passed beyond the experimental stage and the methods have become practically standardized. But when one comes to deal with the great number of tumors which lie deeply beneath the skin or in the thorax or in the abdomen, one enters a very complex field in which all the resources of physicists and radiologists have failed to secure satisfactory results, and in which opinion on essential matters is in a state of considerable confusion.

Out of this mass of data I think one can extricate and emphasize one principle of radiation therapy which is of the first importance. It has long been observed that when one radiated certain deep-lying tumor of the more resistant class, such as adenocarcinoma of the corpus uteri or osteosarcoma of bone, the tumors failed to disappear, but their growth was inhibited and the tumors remained in a state of suspended growth with somewhat altered structure of a less malignant type. It has even been claimed that an adenocarcinoma might be converted into a harmless adenoma. Under such treatment I have observed an osteosarcoma become converted into a solid, quiescent, highly osseous tumor.

These observations indicate that radiation is capable of restraining the growth of tumor cells without causing either autolysis or necrosis, and of transforming functionless lawless cell growths into more organized and functioning tissues. This action is exerted also on proliferating connective tissue and on a wide variety of simple inflammatory and functional hyperplasias, and forms the basis of radiotherapy in many diseases outside the realm of tumors. If these deductions are correct, then this property of radiation is an extremely important addition to general therapeutics. For the first time in the history of medicine we are in possession of an agent which will control the growth of connective tissue. This tissue is the main element in the lesion which underlies many chronic and practically irremediable diseases, so that the search for such an agent has been the faint hope of pathologists for many decades. Aside from the practical question of its successful application, this property of radiation

is of very great scientific interest. For this property we may safely conclude that its action is both specific and selective. Normal tissues and organs are distinctly less sensitive than neoplastic and hyperplastic. Even normal lymph nodes resist radiation when inflammatory hyperplasias yield readily. We may also claim that its action is *secundum Naturam,* in that when properly employed it inhibits that reaction in excess which Weigert emphasized as the significant physiological element in productive inflammation and which exists also in many neoplasms.

We have thus reviewed three main principles of radiation therapy which appear to be fundamentally different, and each of which is selective, specific and tends to support natural processes of defense. These are:

1. Autolytic degeneration, observed mainly in the group of embryonal tumors.

2. Caustic destruction, employed in the treatment of resistant adult squamous carcinoma by bare radium emanation tubes, active deposit of radium and heavy doses of hard gamma and x-rays.

3. Growth restraint, illustrated in the slow recession of resistant tumors under deep radiation and in the treatment of chronic inflammatory hyperplasias.

In further support of the view that radiation therapy tends to employ and support Nature's methods of healing, we may consider at this point whether the regression of a tumor tissue under radiation may not increase the local and general immunity against cancer. We know very little about natural immunity or resistance to cancer, but clinical experience and experimental data show that there is such a physiological property in the organism. The most direct experimental evidence was obtained first by Gaylord and Clowes, who observed that animals in which spontaneous absorption of tumors had occurred became much more refractory to implantation. I recall that dogs which had recovered from the infective lymphosarcoma after injection of normal blood became quite refractory to this quite viable tumor. When, therefore, a bulky tumor in a human subject is caused to

regress under radiation and its autolytic products are absorbed, we seem to have an exact parallel to the experimental immunization of animals. Whether the resulting immunization, if it occurs at all, is sufficient to prove of practical importance, can only be determined by long clinical experience; but radiologists are certainly justified in looking carefully and critically for such results and in assuming their probable occurrence. One may regard the apparent postponement of metastases in partially regressing malignant tumors as evidence of increased immunity, just as one concludes that resistance is diminished when, after the extirpation of a primary tumor, hidden metastases often spring up rapidly and exhibit increased growth capacity. Apparently the body can produce only so much tumor tissue in a given time, and when a primary tumor exhausts this capacity the progress of secondary growths must be limited. All these considerations, which at present lack definite form, open up new points of view regarding the physiological significance of the cancer process and must have an influence on therapeutic conceptions of the future.

Does Radiation Ever Stimulate Tumor Growth? Any adequate answer to this question must recognize the complexity of the problem involved. The question is raised by clinical radiologists who have observed very rapid recurrence and widespread extension of unsuccessfully radiated tumors and who naturally suggest that improper radiation may actually stimulate the growth of tumor cells. The most striking cases are those in which long-continued radiation fails to destroy the tumor cells and produces much scar tissue, in which tumor cells persist, from which they eventually extend, often with considerable activity, into surrounding tissues. Occasionally this is followed by unusually rapid generalization of the disease. The explanation of these cases is a complex pathological problem.

It is said that prolonged radiation may transform the relative susceptibility of tumor cells and stroma, so that the tumor cells become more resistant than the stroma. I have seen well-stained and apparently viable cells of squamous carcinoma lying long persistent in heavily radiated hyaline acellular scar tissue. I

think the better explanation is that the tumor cells actually do become resistant, but mainly because they are protected from the natural defense reactions which cannot take place in acellular, nonvascular scar tissue. Obliterating arteritis which follows prolonged radiation paralyzes these defense reactions over a wide territory in which tumor cells may later grow without restraint. Chronic infections often become established in such tissues and facilitate the spread of the tumor process. Finally, prolonged radiation undoubtedly may injure the whole organism, especially the blood-forming functions, so that to the tumor cachexia is added the damage of prolonged radiation, producing those rapid terminal extensions of the disease which many observers have regarded as accelerations of growth from the stimulating effects of radiation. I have performed autopsies on several such cases and have been much impressed by them, but I am not convinced that equally rapid terminal extensions do not occur without previous radiation. As a very uniform rule autopsies on radiated cases reveal much less tumor tissue and much more fibrosis than we were accustomed to see before the advent of radium. In such enfeebled subjects tumor cells may grow without restraint. Radiologists are agreed that cachectic subjects seldom do well under any form of radiation.

There is much experimental evidence to show that small doses of rays accelerate growth by stimulating mitosis and intracellular metabolism. Vegetable seeds have germinated more rapidly and plants have doubled in size under *x*-ray influence. In animals the results are much less convincing and many complicating factors enter into the experiments, so that one may accept with considerable hesitation the law formulated by Arndt that small doses stimulate while large doses kill the cells.

From the extensive literature on this subject I draw a somewhat uncertain impression. Thus, Hoffman exposed frog larvæ to 20 to 40 per cent of the erythema dose of *x*-rays and found that the majority of individuals showed moderate definite increase in size and increased metabolism. This condition contained for two weeks, and then diminished, and after three to eight weeks

FIG. 1.—Plasma-cell reaction about island of infiltrating carcinoma of bladder, produced by local radiation in the bladder.

FIG. 2.—Diffuse lymphocytic and plasma-cell reaction in endometrium following caustic effect of local radiation, in cases of cervical carcinoma.

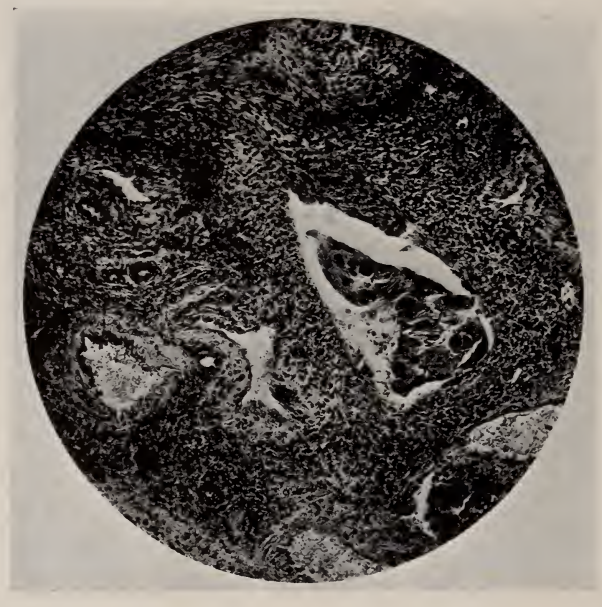

FIG. 3.—Lymphocytic and plasma-cell reaction in squamous carcinoma of cervix invading parametrium, from local radiation through vagina.

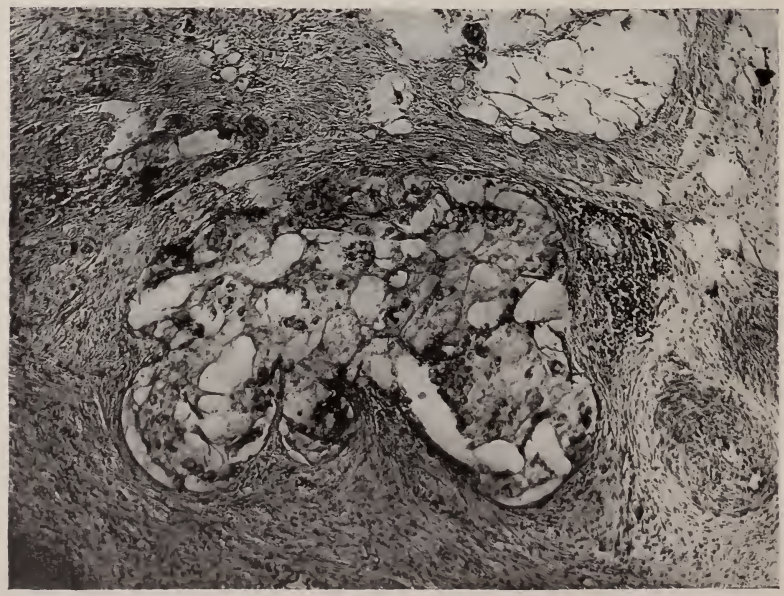

FIG. 4.—Adenocarcinoma of rectum. Vacuolar degeneration of tumor cells five weeks after insertion of bare emanation tubes in the vicinity.

the animals could not be distinguished from controls. Yet in two experiments only diminished growth and injury were observed. When the animals were placed in 10 per cent sugar solution even 10 per cent of the erythema dose always caused injury. It thus appeared that stimulation effects depended on the chance of applying just the right dose to animals in just the right condition. Failla and Suguira saw definite acceleration of growth in young mice exposed to small doses of radium.

While O. Hertwig saw acceleration of the mitotic process in eggs of Ascaris megalocephala, the doses employed were extremely minute. The numerous studies on the effects of radiation of embryos reviewed by this author in *Lazarus's Handbuch d. Radiumbiologie u. Therapie,* all indicate that embryonal cells always receive injury and inhibition even with very small doses of radium rays. Murphy seems to have succeeded in increasing the number of circulating lymphocytes by applying small doses of *x*-rays over the spleen and the marrow of guinea-pigs; but it seems probable that this increase, in so far as it surpasses increased mobilization of preëxisting cells, is the result of regeneration after injury of these cells and tissues.

The main practical conclusion I wish to draw from all these data is that the danger of stimulating the growth of tumors by the present methods of radiotherapy is extremely remote, while the idea that inadequate radiotherapy can endow the cells with increased vitality is quite unreasonable.

Deep Radiotherapy. The most difficult problems of radiation therapy have arisen in the effort to deal with deep-lying tumors, either primary or secondary. During the past few years and up to the present time this has been the great field of investigation, debate and experiment, as it will probably remain for many years to come. At present the physicist dominates the situation. Observing that superficial or accessible tumors may generally be made to disappear by adequate and generally severe radiation, the physicist has been called upon to devise means of delivering the same dosage at various depths in the body without injuring the skin. According to Kepler's law, the amount of energy

received at any point varies inversely as the square of the distance, so that it became necessary to increase the source of energy, the distance, the filtration and the time of exposure. The radium pack, containing two or more grams of radium, and the modern high-voltage *x*-ray machine are the two methods employed to deliver the necessary energy to the deeper tissues.

From the physical point of view the results have been highly successful. In all large clinics data are available by which it is possible to accurately compute just what elements must be provided in the dosage to deliver at any point in the body the required energy. Since, according to physical conceptions, the physiological effect is exactly in proportion to the atomic weight of tissue elements, it is possible under most circumstances to compute the effective dosage. Rather implicit reliance has been placed, especially in Germany, on the theory that if the so-called killing dose has been delivered the tumor must disappear. Thus we have the expressions, "carcinoma dose" and "sarcoma dose," the former considerably above and the latter generally below the erythema dose. Seitz and Wintz originated and still adhere to the idea that there is a standard carcinoma dose which they place at 90 to 110 per cent of the erythema dose, and which is the least amount which can properly be employed in dealing with deep carcinomas. The sarcoma dose ranges from 60 to 80 per cent of a carcinoma dose. Although this conception has been vigorously attacked by many German roentgenologists (Werner, Jungling, Perthes), it has had considerable influence if not a controlling effect on the deep therapy of the present time.

Several expedients are employed to intensify and increase the depth dose without injuring the skin and other normal structures. Two and even three sources of rays may be employed simultaneously, Numerous skin portals are arranged through which at successive times the rays may be centered upon the deep tumor. The influence of scattered rays, those developing within the tissue, have been found to be highly important, and various expedients are employed to increase these rays.

Concentration of Scattered Rays. When a beam of x-rays passes through tissue it loses by absorption at the surface and at all levels in the tissue, in addition to the diminution dependent on the inverse square law. It also loses by the scattering of the rays as they impinge upon tissue molecules. On the other hand, if a sufficiently large volume of tissue is irradiated, the scattered and secondary radiations will effectively increase the depth dose. These losses are partly compensated by the development of secondary rays produced by the impact upon tissue molecules. Both the scattered rays and the secondary rays increase with the hardness of the original rays. They also necessarily increase with the breadth of the original beam, and correspondingly if two tubes, both yielding broad beams, are employed.

Chaoul has endeavored to increase the effect of scattered rays by enclosing the body or limb in paraffin in a square 20 x 20 cm., by which the rays from a wide territory are "collected," as it were, and turned into the tissues from all sides. By this means also the radiation becomes more nearly uniform at distances from the center of the beam. By using such apparatus, with 210,000 volts at 50 cm. distance, 1 mm. copper filter, two portals, he secures at 20 cm. depth 90 to 93 per cent of the skin dose. The therapeutic results of this method are not yet known, but from the physical side it is obviously of much promise.

All of these details of the modern deep therapy have been ingeniously conceived and skilfully employed with the idea of delivering the killing dose to the deep tumor, and upon the theory that the heavier the dose the better the result must be. It is too early to formulate definite conclusions regarding the clinical success of deep radiation therapy, although certain principles seem to be defining themselves in this field; but it is certainly advisable that the principles on which deep radiation is based should be carefully scrutinized.

From the study of much material, from operation and autopsy, in cases treated by deep radiation, I have become convinced that the clinical results are not usually due to the direct killing effect of radiation, but are generally brought about indirectly and mainly

by interference with the circulation—capillary, venous, arterial and lymphatic. This conclusion is in accordance with the rule of pathology that acute necrosis of tissue cells generally means interference with blood supply. In the examination of many bulky cellular tumors of the thorax and the abdomen, which regressed rapidly under radiation, one finds broad areas of simple or liquefaction necrosis, mainly in the center of the tumor, which can only be explained as the result of infarction, while small cell groups on the periphery of the tumor appear well preserved and little affected. If the surviving cells are viable the tumor recurs, but in certain cases these cells are not viable—they slowly degenerate and a clinical cure results. In any case the main part of the destruction has been caused by occlusion of bloodvessels. In the case of most deep-lying infiltrating and desmoplastic carcinomas there is less opportunity for infarction and the tumors do not regress rapidly. Such tumors exhibit isolated foci of necrotic cells, marked hydropic degeneration, interstitial hemorrhages, granular and mucinous degeneration of collagen fibrils, but usually some areas in which the cells appear well nourished and viable. After several weeks, sclerosis of injured bloodvessels appears, which shuts off the circulation. The tumor tissues then undergo progressive fibrosis, but usually groups of tumor cells persist in the scar tissue and later give rise to recurrences. From many observations of this type I have drawn the conclusion that it is very difficult to destroy the average deep-lying carcinoma and that the so-called sterilizing or killing dose is considerably higher than it is generally placed.

Not all deep tumors, however, escape with remnants of persisting cells. Some yield completely to deep therapy, and these are almost invariably of embryonal type, as carcinoma of the testis, or of lymphoid character, as lymphosarcoma or myeloma. I have also seen complete regression and fibrosis of soft fascial myxosarcoma in the pelvis. With certain embryonal tumors of the kidney in infants (Wilms' tumor), one-quarter of the erythema dose has been found to cause very rapid regression of the tumor and serious collapse of the infant patients.

Fig. 5.—Extensive hornification of squamous carcinoma in ischiorectal fossa in case of anal carcinoma, by local implantation of radium emanation needles.

Fig. 6.—Cervical lymph node invaded by squamous carcinoma of tongue. Treated with bare emanation tubes three weeks before removal. Extensive destruction of tumor cells, diffuse fibrosis, thickening of capsule. Small groups of tumor cells are still visible.

Fig. 7.—Squamous carcinoma in lymph node. Destruction of tumor tissue, fibrosis of capsule and preservation of uninvolved lymphoid tissue, one month after insertion of bare emanation tubes.

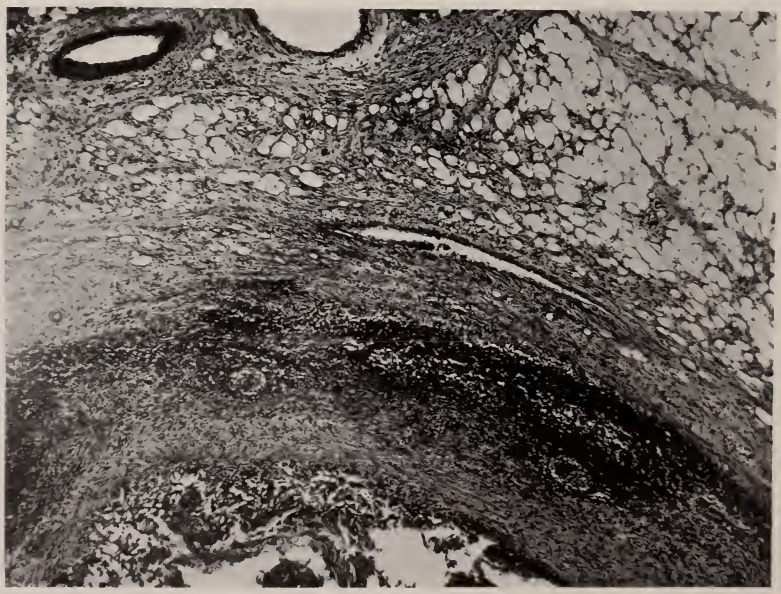

Fig. 8.—Squamous carcinoma in lymph node. Destruction of tumor tissue and fibrosis of capsule of node, see above, one month after insertion of bare emanation tubes.

Nevertheless, the usual failure to completely eradicate malignant tumors by deep therapy leads one to conclude that this method of attack will gradually be replaced by the exposure of the tumor and more direct application of the agent, especially the insertion of radium needles in the tumor tissue. In this way it will be possible to injure the tumor while sparing the surrounding tissues.

The theory that it is best to deliver a killing dose of filtered radiation to deep tumors is not supported by clinical results. These results, with the exception of certain very sensitive tumors, are distinctly disappointing. Moreover, they are accomplished very often with so much disturbance of the vitality of the patient, and with such frequent damage to intervening normal organs, that there appear to be distinct limitations to this method of treatment. Not infrequently, when the tumor has been successfully radiated from the physical standpoint, the patient dies from hemorrhage into or about the tumor, or from severe infection in the degenerating tumor tissue, or from absorption of secondary decomposition products of the tumor. The slower absorption of ordinary autolytic products is usually accomplished without any signs of intoxication, and there is no good reason to believe intoxication results from limited areas of aseptic necrosis so long as the material remains free from infection and secondary decomposition.

On the other hand, when one proceeds in deep therapy on the theory that therapeutic results depend not only upon injury to tumor cells but also upon defense reaction of the body and the tissues, the immediate results seem to be almost equally striking, the end-result is often more satisfactory and the treatment is conducted with less damage and danger to the patient. By employing less than the killing dose and repeating the exposures at intervals, most of the embryonal and lymphoid tumors react as well as with very heavy dosage. With an *x*-ray voltage of 90,000 and with properly filtered radium packs at 6 to 10 cm., giving 9000 to 20,000 mc. hours, we have been observing for some years at the Memorial Hospital satisfactory regression of this

class of tumors, many patients remaining free from demonstrable recurrence up to the present time. These results have been accomplished without notable disturbance to the patient or injury to the skin. These cases include abdominal metastatic carcinoma of the testis, embryonal tumors of the ovary, lymphosarcoma, Hodgkin's granuloma, leukemia, mixed tumors of the salivary glands, giant-cell tumors of bone, cellular osteogenic sarcoma and myeloma. The oldest of these cases, a bulky teratoid tumor of the ovary, in a girl of eight years, is now of seven years' standing, and the patient is a healthy young woman, menstruating normally.

The process leading to these results has certainly not been the direct destruction of tumor cells. Many of the cases have required repeated exposures, and long periods often passed before the outcome was determined. It seems more probable that slow autolysis and growth restraint, aided by the natural defense reactions of the body, combined to bring about a gradual regression and eventual disappearance of the tumors. With the more adult and resisting tumors, such as recurrent mammary cancer, extensions of uterine cancer, corpus carcinoma, gastric and intestinal carcinoma, and most osteogenic tumors and sarcomas, external radiation has been mainly palliative, growth restraint has been effected, the tumors have long remained quiescent and sometimes harmless, the life of the patient has been prolonged, but the tumor has not been eradicated. That better results will come from the higher *x*-ray voltages, 250,000 and more, with corresponding technical adjustments, or with radium packs at 15 cm., delivering 40,000 mc. hours' continuous exposure, seems not improbable. The present reports from these extremely intense treatments are in many respects highly encouraging, but the good results obtained may not be hastily attributed to the killing effects of the high dosages.

Finally, the uniform experience that no form of radiation yields any great success in debilitated or cachectic subjects emphasizes the principle that radiation therapy, rationally conducted, relies heavily upon the healthy reaction of the affected tissues and the

whole organism. From these data the following general conclusions regarding deep therapy seem to be justified:

1. The physicist having provided instruments yielding high and controllable dosage, the use of the instruments is strictly a medical problem.

2. The successful treatment of deep tumors requires the careful adjustment of dosage to the individual case, with due regard to the age and condition of the patient, the type, structure and natural history of the tumor and the relations and functions of the affected and surrounding organs. Every tumor is a study by itself. No uniform carcinoma or sarcoma dosage can ever be established. Results will not improve merely with increase of dosage.

3. Deep therapy cannot safely proceed on the theory of direct killing of cancer cells. Slow autolysis, growth restraint, focal necrosis from anemic infarction, reduction of blood supply, encapsulation and fibrosis are the most effective processes excited by deep radiation.

4. With the exception of embryonal, very cellular and lymphoid tumors the results of deep radiation are generally unsatisfactory, and palliation rather than cure is usually the safer goal.

5. On account of these limitations the progress in the treatment of deep tumors will probably turn more and more in the direction of exposing the tumor and applying the agent more directly.

Adjuvants to Deep Radiation Therapy. Recognizing the limitations of radium and *x*-rays in dealing with deep tumors, many workers have endeavored to fortify the radiation by several expedients.

Sensitization by Iodine. It has long been known that iodine administered by the mouth tends to be deposited in tumor tissue, partly uniting with glycogen and partly filtering out in degenerating tissues. Jess reports that after injection of iodine in considerable doses for several days, after disappearance of iodine from the urine, 71.6 per cent remains in the body. Since iodine yields characteristic secondary rays, administration of this agent

may possibly intensify the effects of radiation. Although this expedient has been employed by several workers, there are no satisfactory reports as to its efficiency.

Iodides have long been employed in the treatment of maligant tumors, and rarely one sees remarkable regression of cellular tumors during its use.

Iodine stimulates the function of the thyroid gland, and since thyroid extract has had a long history in cancer therapy, not without results, it may act secondarily in this manner.

Schwartz suggests that the main dose of radiation be given at the height of the hyperemia produced by a preliminary dose, and he would further employ injections of tumor autolyzates at the same time.

A considerable variety of metals, simple and colloidal, and of organic extracts, have been employed, by local and intravenous injection, to stimulate blood formation and render the tumor more susceptible. Kupferberg claims to have tried and abandoned them all, and regards as valuable only blood transfusion.

Wetterer treated a cachectic case of gastric carcinoma with deep therapy, and at the same time with blood transfusions from the patient's twenty-one-year-old daughter, and saw very striking improvement in the tumor and in all symptoms which had not been relieved by raying alone.

In 1910, I found de Keating-Hart, in Paris, packing tinfoil into the recesses of a very extensive rodent ulcer, connecting it with another electrode on which the patient lay, and turning on the electric current until the patient complained of heat. He stated that it was impossible to cure such advanced cases with *x*-rays alone, but that they sometimes yielded completely when the temperature was raised. There are many limitations and several hazards connected with the artificial elevation of the temperature of tumors, especially from hemorrhage, but the influence of heat as an adjuvant to radiation has not received the attention it deserves.

All of these studies, aimed primarily to intensify the effect of radiation, while they may not yet have yielded definite results,

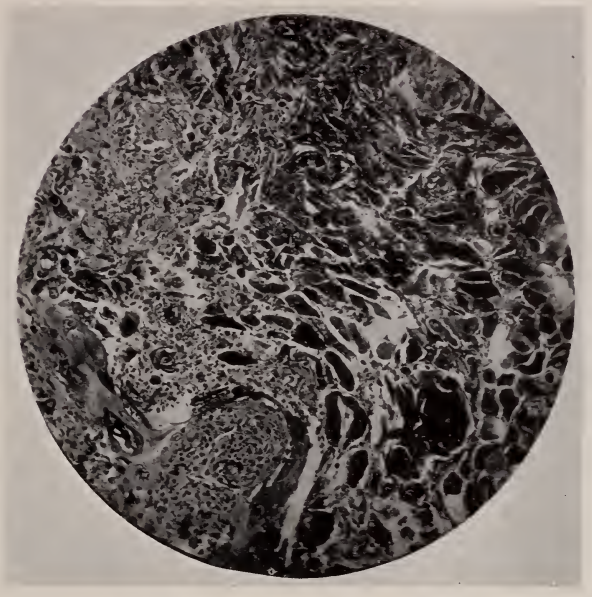

FIG. 9.—Hornification and desquamation of cells in squamous carcinoma in lymph node. External radiation.

FIG. 10.—Mammary carcinoma treated with bare emanation tubes. Destruction of tumor tissue, lymphocytic invasion, fibrosis and calcification. The small cells are lymphocytes.

FIG. 11.—Rat sarcoma treated by injection of radium deposit, showing diffuse simple necrosis. Removed after ten days. (After Bagg.)

FIG. 12.—Cavity from liquefaction necrosis and area of simple necrosis produced by radium emanation needle in muscle tissue of rabbit. (After Bagg.)

are of much theoretical interest. They probably indicate the direction in which progress is to be made in the future, and they seem to the writer more rational than the effort to steadily increase the dose of radiation.

THE INFLUENCE OF RADIATION THERAPY ON THE KNOWLEDGE AND CONCEPTION OF TUMORS. The experience with radiotherapy has forced workers in this field, and surgeons and pathologists generally, to pay much closer attention to the natural history of specific neoplastic diseases. Indeed, many new facts and principles of tumor growth have been brought to light and emphasized which before were only vaguely appreciated. No one can safely engage in this work without considerable acquaintance with these matters.

The distinction between embryonal and adult tumors forms a very sharp line of cleavage in the results of radiation, and must be carefully considered in establishing the correct dosage and estimating its effects. Not only rodent ulcer, but the entire extensive group of basal-cell carcinomas, including salivary gland tumors and cervical carcinoma, run true to form in respect to radiation. Many other tumors, at all ages, which have yielded promptly to radiation have taken their place among embryonal tumors, although previously their nature was not generally appreciated.

The distinction between embryonal and cellular anaplastic tumors is equally important, but much more difficult to detect; but until this is done many radiologists will continue to meet surprises and disappointments. Thus a very cellular anaplastic mammary cancer will resist most efforts at local destruction and will regularly kill by generalization, while an equally cellular embryonal tumor may melt down rapidly and neither recur nor generalize. On account of this embryonal character, most tumors in children do better than expected, so that aggressive therapy cautiously employed is generally advisable at such ages. On the other hand, nearly all the round-cell carcinomas of adults are anaplastic adult neoplasms with very unfavorable prognosis.

The desmoplastic properties of tumors, with the production of

much stroma, without much regard to the character of the cells, render the tumor highly resistant. To bring such growths to a standstill, without marked reduction in size, is all that can be generally hoped for, and for this purpose the caustic action of radium or *x*-rays is usually needed. Thus fibrocarcinoma may recede but seldom disappears under external radiation, and seems to require radium needles.

New emphasis has had to be given to the differences between many fibrous tumors which are difficult to explain. Keloid and fibromyoma uteri respond to radiation to a degree which their structure did not suggest, while neurofibroma in all its phases proves extremely resistant. On the other hand, fascial sarcoma, which is difficult to separate clinically from neurosarcoma, is very sensitive to radiation on account of its richness in delicate capillaries, which are absent in neurosarcoma.

The variable response of different tumors to radiation constitutes an important department in radiotherapy which is of much value in diagnosis. The therapeutic test critically applied serves to distinguish sharply between many tumors which cannot be separated clinically, has greatly extended the means of diagnosis of tumors and reduced the indications for biopsies, laparotomies and frozen sections. Mainly by this means I have recently been able to call attention to the existence of a specific group of round-cell tumors of bone which had previously been submerged under the term "round-cell sarcoma," but which differ from cellular osteogenic sarcoma in being very susceptible to radiation.

The radiologist must not only be familiar with the structural and biological differences between the various classes of tumors, but he should be able to visualize the peculiarities in structure in different cases of the same tumor. Compare, for instance, two tumors of the testis which may be found of exactly the same size. One is a slowly growing, hard, adult teratoma composed of epidermoid cysts, cartilage and adenocarcinoma (Curling's hydatid disease). The other is a more rapid growth, firm but elastic, and consists of embryonal carcinoma with lymphoid stroma. The former will resist all attempts to reduce its size,

but it will seldom recur if excised after radiation. The latter will disappear rapidly under radiation, greatly impressing the operator, but soon recurring in the abdominal lymph nodes. Hodgkin's granuloma in its early stages is soft and cellular and will completely disappear under moderate radiation; but in late stages the lesion becomes firm and fibrous and under radiation the tissues are transformed into dense resistant cicatricial masses. Similar changes occurring naturally in the course of tumor growth have led to the unwarranted conclusion that the cells have acquired a new resistance to radiation.

Radiation of abdominal tumors should always be guided by a consideration of the structure of the tumor. One may safely deliver a heavy dosage to myomas of the uterus and to most lymphosarcomas, but I have seen three sudden deaths from hemorrhage into heavily radiated bulky abdominal metastases of testicular tumors which contained many large blood sinuses. In attacking tumors of or in bone or cartilage the operator must proceed with the knowledge that exposed or ulcerating cartilage will never heal.

The importance of the general vitality of the patient is emphasized when the radiologist finds all his efforts fruitless in debilitated and cachectic subjects. Arteriosclerosis, syphilis, anemia and diabetes are among the general diseases that affect the vitality of patients, but they are seldom considered as factors influencing the results of radiation. Local arteriosclerosis is probably responsible for many excessive reactions, for delayed secondary sloughing of tissues, hemorrhages and the persistence of indolent ulcers.

Indeed, successful radiotherapy demands the employment of a broad, general, clinical knowledge upon which the operator must constantly draw in controlling the use of the powerful agents now at his disposal. All these considerations justify the statement that the developments of radiotherapy have opened up a new biology of tumors, have stimulated many new lines of research and suggested new conceptions regarding the physiology of tumors.

Will the body withstand unlimited exposure to radiation? It has long been observed that patients subjected to long courses of treatment by radium, and especially by *x*-rays, sometimes developed a peculiar form of cachexia from which they died, although their tumors had remained quiescent or had practically disappeared. These patients presented anemia, emaciation, great weakness, persistent leukopenia and at times nervous instability with attacks of maniacal delirium.

I have studied at autopsy several cases of this type and found that the pathological conditions vary and depend largely on the nature of the original disease. The bone-marrow regularly exhibits a pronounced reduction in the blood-forming tissue, and that which remains is poor both in nucleated red cells and in white cells, and may show hemorrhages, pigmentation and mucinous degeneration. These changes fully account for the peculiar anemia. The spleen shows evidence of marked draining of white cells, atrophy of follicles and extensive destruction of red cells. A prominent element in the cachexia sometimes appears in the extensive fibrosis which follows regression of the tumor tissue, which interferes with the circulation and function of affected organs. Thyroid atrophy, constriction of great vessels and chronic catarrhal enteritis may be found when the regions of these organs have been greatly exposed. Not infrequently the cachexia is found to be mainly referable to chronic infection, which is very readily established in the debilitated body.

Prolonged treatment of Hodgkin's granuloma usually terminates in very extensive sclerosis of many organs and complete loss of lymphoid tissue throughout the body. A careful general anatomical study is required to trace the factors concerned in various cases. Nevertheless, these observations indicate that there is a limit to the radiation that the human body can withstand. In planning the course of treatment in diseases of chronic course and generally unfavorable prognosis, one should endeavor to avoid too frequent and severe exposures, and should consider whether the patient will not live longer if treated on the expectant plan, prolonging the periods of improvement as much as possible

and thus avoiding the addition of radiation cachexia to the terminal stages of the disease. These considerations apply especially to Hodgkin's disease, leukemia and recurrent mammary cancer.

THE METHODS AND INDICATIONS FOR RADIATION THERAPY. The wisdom of employing radiation in cancer depends first of all on the competence and equipment of the operator. Current literature still reveals wide differences of opinion regarding both

FIG. 13.—Reaction about emanation needle in brain tissue of dog. From left to right: normal brain tissue; cellular area of lymphocytes and new vessels; zone of leukocytes; zone of necrotic tissue; cavity of the needle.

indications and methods in radiation therapy, and these differences are mainly dependent on the experience and technical equipment of the authors. Thus in Germany, and until lately in France, lingual cancer has regularly been classed as unsuitable for radiotherapy, an opinion due solely to the failure to employ radium needles in the tumor tissue. In Germany, *x*-rays have largely supplanted radium, so that German opinions are usually tempered

FIG 14.—Mediastinal tumor, probably thymic, before and after x-radiation, eighteen months. Illustrating slow autolytic degeneration.

by the limitations of the *x*-ray machine. On the one hand we find everywhere the opinions of those equipped only with radium or *x*-rays, or both, opposed to the views of surgeons who use neither or who have a little radium to use on occasions. Quite numerous are the beginners who are deficient in knowledge, experience and equipment and who work their way through stormy paths to various degrees of efficiency. The result is that there are no standard indications or methods in radiation therapy, except in a few minor conditions, and there probably will not be until some central authority establishes these standards and insists that radiologists shall meet them. The time seems to have arrived when a special license or diploma attesting the operator's competency should be required of all who engage in this work. Recognizing the great difficulties in the way of such regulation, many have concluded that the treatment of cancer by radiation should be mainly in the hands of large institutions fully equipped for the diagnosis and treatment of cancer in all its forms and by all approved methods. While endorsing such a plan, I must confess that it hardly does justice to the remarkable achievements of many surgeons who, with great skill and knowledge, but with limited equipment, have often been the pioneers of progress.

Under these circumstances the writer can only offer his own conclusions in this complicated field, which are based mainly on the work of his clinical colleagues at the Memorial Hospital, where radium, *x*-rays and surgery are employed in accordance with the judgment of the staff.

Lymphoid tumors offer the most impressive field for radiation therapy. It is now generally recognized that lymphosacoma belongs exclusively to the radiologist, since the tumors yield rapidly to moderate dosage, and many localized growths never recur. It is highly important to avoid incision for diagnosis, since these tissues are very susceptible to infection and the scars break down under radiation. A discrete, movable node may be safely excised. In generalized systemic lesions the prognosis still remains unfavorable, owing to the wide extent of the disease,

and there appear to be no cures of ulcerating lymphosarcoma of the intestine. Very striking initial results and a few apparently permanent regressions are observed with mediastinal lymphosarcomas, most of which belong with the thymic tumors.

Hodgkin's granuloma presents many problems. While the initial regressions are usually impressive, especially with early cellular lesions, the final results are generally disappointing. The disease recurs after a year or longer, sometimes promptly, and in a more resistant fibrous form, while the tendency toward extensions seems to be little affected. Overradiation leads to extensive fibrosis, anemia and cachexia supervene as usual and the total duration of life is not increased and may be shortened. On the other hand a small proportion of cases seem to be permanently relieved. Since thorough excision of Hodgkin's lymph nodes is rather seldom followed by local recurrence, the indications for surgical interference and radiation in this disease seem not yet finally determined. One can fully endorse the warning given by Yates that overradiation disturbs the nutrition and blood-forming powers of the patient and tends to shorten life. If may well be that the best treatment of Hodgkin's disease is excision of all accessible enlarged lymph nodes, with radiation for the deeper lesions.

Although radiation has proven to be the best treatment for leukemia, the same precautions against overdosage are required, and almost the same disappointments are experienced as with Hodgkin's disease.

Embryonal Tumors in Children. A long list of embryonal tumors occurring in infants and children and in adults, many of which are difficult to classify, respond promptly to external radiation, which should always be employed before the resort to surgery. These tumors include Wilms' tumors of the kidney; teratoma of the ovary and the testis; glioma of the retina, brain and cord; neurocytoma; abdominal and mediastinal teratomas; myosarcoma of the prostate; polypoid cervical myosarcoma; pharyngeal myxosarcoma.

I know of no record of the treatment of chorionic carcinoma by

radiation, but this is preëminently an embryonal tumor and should follow the rule with other embryonal growths.

Cutaneous Cancer. Radium treatment is indicated in all primary cancers of the skin and is successful in the great majority of uncomplicated cases.

Basal-cell carcinomas yield, as a rule, to surface applications of silver filtered radium. An excellent and expeditious method is the one- to two-minute exposure to large amounts (300 to 500 mc.) of emanation condensed in a small glass bulb and applied unfiltered, a method devised by Quick.

Squamous carcinoma is distinctly more refractory and generally dangerous. It may yield to surface applications, but often requires the caustic action of emanation needles. Bulky tumors may first be excavated by electric coagulation or other caustic and the base treated by needles. Very advanced cases, involving mucous membranes or bone, still carry a poor prognosis. Quiescent pigmented moles are better excised. Early melanoma should receive very heavy external radiation, which may be followed by wide excision, but the results are generally poor.

Cancer of the Lip. Although surgical results with labial cancer are excellent, radium accomplishes as much or more without mutilation. These lesions can generally be attacked from three sides by surface radiation, but when deeply infiltrating, emanation needles are usually indicated. All localized operable lesions ought to be destroyed by this method. At the Memorial Hospital during the last three years, since this technic was introduced, not a single operable case has been lost, and many advanced cases are in the group of apparently cured.

Squamous Cancer of the Tongue and the Mouth. By the use of emanation needles inserted throughout the tumor after preliminary radiation, buccal cancer has been transformed from a very grave surgical problem into a comparatively simple and very successful field in radium therapy. The only failures should be inaccessible lesions beneath or behind the tongue, those that invade bone, and very advanced cases. Certain lesions of the cheek also prove refractory and destructive. By the same methods, cancer of the

tonsil may be controlled when not too far advanced. To combat lymphatic invasion the radium pack or x-rays may be applied over both sides of the neck. If definite infection of nodes appears

FIG. 15.—Periosteal osteogenic sarcoma before and after x-radiation. Illustrating growth restraints.

at first or later the nodes may be excised, leaving radium needles in the bed. If the capsules of the nodes are invaded it is probably better to insert radium needles and not attempt excision. In

fact, the writer is inclined to believe, on the evidence available, that lymph nodes invaded by squamous carcinoma should always be treated by radium needles, and usually without excision. In all advanced cases preliminary ligation of lingual or external carotid is a wise precaution, as most of the deaths result from hemorrhage. During the past three years, since the introduction of the proper technic, about 90 per cent of the so-called operable cancers of the tongue and the mouth have shown a complete clinical regression. Some of these will undoubtedly recur, but most recurrences develop within a few months and may respond to further treatment.

Mixed tumors of the salivary glands respond well to external use of radium and *x*-rays, which should be used by preference in all primary cases. Complicated cases present a wide variety of conditions, for which several expedients must be employed.

Cancer of the penis is a refractory form of squamous carcinoma, and it may be mentioned to illustrate the dependence of results on the anatomy of the organ affected. The thin epithelial covering of the glans is closely adherent to the heavy fibrous tunica which encloses the cavernous tissue. While long restrained by the tunica, squamous carcinoma once breaking through finds itself in a roomy system of vessels. The lymphatics leading from the glans are also rich and wide. Finally, the submucosa between the epithelium and the tunica is very thin and affords little opportunity for the cellular reaction following radiation. Accordingly, these carcinomas are difficult to eradicate, but with preoperative radiation, followed by amputation, the results are better than by amputation alone. Yet many early papillary tumors respond well to radium alone.

Uterine Cervical Cancer. Opinions regarding the best treatment of cervix carcinoma still vary widely and follow closely the technical skill, equipment and mental attitude of the operator.

Three anatomical forms of localized cervical cancer should be separated in dealing with this disease, and especially in planning treatment by radiation: (1) Fungating polypoid carcinoma of

the portio vaginalis. (2) Flat carcinoma of the cervical canal, often squamous. (3) Deep-lying carcinomas of the cervical tissues, which often invade the parametrium before they reach the mucous surface. The prognosis by all forms of treatment varies in the order named. Both surgery and radium should cure a high proportion of these localized lesions. But really early localized cervical carcinoma is rarely encountered. The difficulty lies with lesions which appear to be localized but are really extensive, and which the surgeon leaves partly behind or disseminates and the radiologist fails to reach. Thus far statistics seem to distinctly favor the use of radium by an aggressive technic in dealing with apparently localized cervical carcinoma. The technic includes the insertion of radium needles in all the palpable tumor tissue followed by heavy doses of filtered radium from the vaginal route and radium packs or high-voltage *x*-rays over the abdomen. By such treatment, Bailey finds that over 80 per cent of the cases classed as favorable experience a complete clinical regression. Radical surgery has never produced any such primary results, while the frequency and progress of recurrences after radiation are both probably less than after surgery. Under such circumstances little remains of the field for surgery in carcinoma of the cervix. In the group of inoperable cases radiation has now many complete clinical regressions and some five-year cures, besides palliation of a great number.

I have seen pronounced radium changes in cancer cells in deep iliac nodes receiving external radiation, but have never had opportunity to prove that external radiation can completely destroy such metastases. The most that can be reasonably hoped for is retardation of the process. Yet Perthes reports one case of cervical carcinoma completely cured by deep *x*-ray therapy, and the Germans seem to place great reliance on this method in dealing with this disease. From their reported results it would seem advisable to employ deep *x*-ray treatment in all cases in addition to the local treatment by radium.

Having failed to find any trace of carcinoma in several uteri which had been the seat of well-established cancer and were

treated by radium as above outlined, I am not impressed by the wisdom of performing hysterectomy after radiation. Yet it cannot be denied that hysterectomy may possibly eradicate some degenerating but viable foci of cancer cells which might later give rise to recurrence. It seems equally if not more capable of loosening and disseminating outlying cell groups which under heavy radiation would long remain harmless. Yet if the case cannot receive the full radiation in the most approved manner, and if the disease is not advanced, it is probably better to extirpate the uterus a few weeks after treatment.

It is evident that the correct choice of treatment of cervical carcinoma raises many problems which can only be solved by much careful clinical study by radiologists and surgeons using the best technic. The experience with the radiation of advanced cancer clearly calls for a reduction in the scope of operability in this disease in the practise of those who do not use radium.

The unexpected success of radium treatment of cervical carcinoma seems attributable to two main factors: (1) The cervical tissues form a resistant filter so that relatively large doses of radium can be inserted in the canal and in the tumor tissues. (2) The majority of cervical carcinomas resemble the basal-cell tumors and are more susceptible to radiation than squamous carcinoma. On the other hand, the inaccessibility of cervical carcinoma will always render it very difficult to extirpate this organ without disseminating tumor cells. These facts will probably assert themselves sooner or later in the final decision as to the choice of treatment of cancer of the cervix.

Corpus Carcinoma. This disease occurs in quite varied forms which present very different therapeutic problems: (1) A localized, fully developed, malignant adenoma covering a limited area in any part of the endometrium. (2) Diffuse adenocarcinoma involving the entire endometrium. (3) Diffuse adenocarcinoma of both endometrium and tubes. (4) A diffuse, superficial, partly developed adenocarcinoma, intermediate between hyperplastic endometritis and true carcinoma, of moderate malignancy and often curable by curettage. (5) Diffuse adenomyocarcinomatosis

affecting both endometrium and myometrium. (6) Localized carcinoma arising in an adenomyoma.

Anyone who attempts to treat corpus carcinoma by radiation should endeavor to visualize the anatomical conditions in these different types of the disease. The examination of curettings is only the first step in this undertaking.

The difficulties of determining the exact local condition and the considerable success of hysterectomy seem likely to render the progress of radiation therapy in this field slow. Hysterectomy should be preceded by radiation while the superficial cases of moderate malignancy may be entrusted to radiation alone. As a rule, corpus carcinoma has been undertreated, and it should be realized that malignant adenoma is relatively resistant, requiring 4000 to 8000 mc. hours in the uterus. I have examined several uteri which had been treated by smaller dosage up to 3000 mc. hours and have found islands or diffuse areas of adenoma malignum which had remained quiescent but had survived over periods of one to four years.

Myoma Uteri. It has been abundantly shown that radiation produces a symptomatic cure in the great majority of uterine myomas, with reduction in the size of the tumor and relief of pressure and hemorrhage. Complete disappearance of the tumor is generally reserved for the small or medium-sized and softer growths. The hazards of sterilization have probably been overdrawn, but the danger of stirring up old pelvic infection is very real. The proper place of radiation treatment of myoma uteri will doubtless be determined in due time, according to clinical experience.

The recent analysis of this subject by Clark and Keene leaves little more to be said. Gellhorn also presents the indications for and results of radium treatment of uterine myoma from the most mature experience. Yet some observers believe that it is unnecessary to submit all these patients to an elaborate gynecological technic when they can often be cured by external treatment with radium or *x*-rays. Gauss and Friedrich report that about 75 per cent of the myomas they treat show complete disappearance

with deep x-ray therapy. All the bad results that I have seen with the radiation treatment of myomas have occurred in cases in which the uterus was dilated, the mucosa curetted off and radium inserted into the cavity. This familiar procedure is not without some hazards, as it prolongs convalescence and converts the treatment into a substantial gynecological operation which may not always be necessary. Before the days of radium I performed autopsies on the bodies of women who died from latent infection stirred up by simple exploration of the uterus or curettage.

The sophistry of using the alleged sarcomatous degeneration of myomas as a bar to radiation has been sharply rebuked by Clark. Radiation is probably the best treatment for sarcoma of the uterus. As for the small percentage of myomas associated with corpus carcinoma, it is assumed that competent gynecological examination precedes any treatment.

The steady and often rapid regressions of these large and rather cellular tumor masses are quite surprising and difficult to explain. The tumors undergo edematous softening and liquefaction with formation of cysts, or there may be widespread, simple necrosis with shrinkage and fibrosis. The result seems referable in part to the inhibition of ovarian function, but mainly to the sclerosis of bloodvessels, and often, as Gellhorn states, to direct injury of muscle cells.

Mammary Cancer. The radiation treatment of mammary cancer has been pursued much more seriously in France and in Germany than in America. From Germany come several reports of complete eradication of the disease by deep roentgen therapy. While the primary results are often encouraging, I do not believe x-rays can be relied upon to effect a complete local regression except under very favorable conditions. Histological examination of mammary cancers heavily treated by x-rays reveals a series of striking changes with extensive destruction of tumor cells, but in the residual scar tissue some tumor cells in my material have usually survived. The combination of radium needles in the tumor and lymph nodes, with x-rays externally, has been employed in France with encouraging success. This method employs the

caustic action of radium, which seems to be required in most forms of glandular and desmoplastic carcinoma. Regaud considers this plan of treatment to be reliable, but in order to meet objections from the surgical side, would perform the standard operation afterward. At the Memorial Hospital, Lee reserves radiation for poor surgical risks, for women over seventy years of age and for inoperable cases. The results seem to justify this plan for the present time. Some of the earliest cases treated in this way four years ago by Janeway remain well today.

Preliminary *x*-ray treatment has established itself with most observers as an indispensable preliminary to radical operation. Postoperative treatment is widely employed and enjoys a definite theoretical support, but its value is difficult to judge. It may destroy or render inert outlying foci or implanted cell groups. For inoperable cases systematic radiation prolongs life and reduces suffering in the majority of cases, but probably not in all, while there is no satisfactory evidence that it can completely eradicate the disease when it has passed the local lymphatics.

On account of the extremely variable anatomical and clinical characters of the disease, the difficulty of diagnosis, the danger of disseminating the disease by surgical manipulation, the extent of the radical operation and the frequency of recurrences, I believe that combined radiation therapy in the above form is destined to largely replace the surgery of mammary cancer. This problem must be worked out on selected cases over a long time period, and the answer seems likely to come from European sources before we in America are prepared to accept it.

Rectal carcinoma seems to be sought by neither surgeon nor radiologist. The cases that reach the radiologist are usually advanced and complicated, and with them eradication of the disease is rare and palliation far from certain. The caustic action of radium is required with these adenocarcinomas, which usually excite much new connective-tissue growth. Quick employs radium needles in the tumor, in relatively high dosage, followed by extirpation of the involved area by electrocoagulation. More superficial lesions which have not passed the muscular coat

should be amenable to the implantation of radium needles. I find no impressive statistical reports and no indications that the disease can be controlled by the high-voltage *x*-ray machine.

Tumors of Bone. I have elsewhere discussed at some length the radiation treatment of bone tumors, with the following conclusions:

Benign giant-cell tumors need not, as a rule, be incised for diagnosis nor curetted for treatment, since they yield characteristic radiographs and gradually regress when patiently treated by external radiation.

The round-cell tumors of bone regress rapidly under radiation, but the prognosis is generally poor because of multiple lesions and metastases.

Osteogenic sarcoma generally resists external radiation, but when this is combined with insertion of radium needles the progress of some tumors of this malignant class may be stopped.

Brain and Cord Tumors. External radiation controls the growth of many cellular tumors of brain and cord with relief of symptoms in many and with apparently permanent relief in a few. The skull is no serious bar to treatment and the normal tissues are resistant. The possibility of destroying many more brain tumors by exposure and the insertion of radium needles has never been submitted to a satisfactory test. There is a very urgent call for recognition of these facts by neurological surgeons. Frazier and Pancoast have made a substantial beginning in this field.

Prostatic cancer is best treated by insertion of radium needles within the tumor. Filtered radiation through the rectum and the urethra gives a slight additional effect where it is most needed. Bumpus would limit the rectal dosage to 600 mc. hours and the urethral dose to 400 mc. hours. When the disease is confined within the capsule of the gland or its immediate vicinity this method should be successful, and clinical reports of a moderate number of successful cases support this belief. Yet very few cases of prostatic cancer are recognized in the early stage.

Carcinoma of the bladder has been successfully treated by Barringer, Young and others, by insertion of radium needles into the

base of the tumor and the surrounding tissue. Fatal cystitis and suppurating nephritis are, however, rather frequent complications of this method, especially in cases with previous infection. The results are generally recognized as a distinct improvement over those secured by simple extirpation.

Tumors Not Now Amenable to Radiation. Melanoma is, most unfortunately, highly resistant to all forms of radiation which produces at most only temporary slowing of growth. In that form of the disease which tends to confine itself to lymph nodes there may be some indication for inserting radium needles in the nodes, but the generalizing forms are not benefited. To remove a suspicious pigmented mole requires the caustic action of radium.

In epithelioma of the esophagus there is very little evidence that definite improvement in the lesion can be secured by surface application of radium. There are a few isolated reports of successful cases, but there is great danger of doing more harm than good by passing radium tubes into the esophagus. The very thin epithelial lining of the esophagus, its rich vascular and lymphatic connections, the proximity to vital structures and the rapidly invasive character of its epithiliomas indicate that cautious palliation is all that should be attempted.

Gastric Cancer. The inaccessible location, the anatomical conditions and the results thus far obtained do not encourage the hope that any technic will soon be devised capable of controlling this the most frequent form of cancer. I have seen one adenocarcinoma of the pylorus completely destroyed by radium needles inserted into the tumor from within, but the patient died in two weeks with uncontrollable vomiting. The radium dosage was much in excess of the need.

On the other hand, external radiation has produced some remarkable results in relieving stenosis and in restraining the growth of advanced cases. With diffuse carcinomas, combined with gastroenterostomy, external radiation has a limited but important field. Since gastroenterostomy alone may be followed by much improvement in the patient's condition, the credit in some of these cases must be assigned with caution.

Neurosarcoma is strongly resistant to all forms of radiation. About 150 cases of this disease, mostly recurrent, have passed through the Memorial Hospital in the last three years, and usually without notable benefit. Persistent external radiation seems to have controlled a very few.

Epithelial tumors invading bone or arising within it, as adamantinoma, should be treated surgically, since severe radiation of bone produces painful necrosis and generally fails to affect the tumor.

Carcinoma of the larynx, except in early intrinsic lesions, offers many difficult problems for both surgery and radiology, in which radium has furnished very limited aid. Quick's method of applying short exposures of large amounts of emanation compressed into a small glass bulb seems to have controlled some early intrinsic lesions.

THE INFLUENCE OF RADIATION THERAPY ON THE CANCER PROBLEM. Will the possession of new physical agents capable of controlling localized accessible cancer influence the general aspects of the cancer problem? Will the wide and efficient use of these agents affect the death-rate as shown by the United States Census, or will the benefits be confined to the comparatively few individuals who early visit the modern cancer clinic while the major portion of the sufferers continues to be sacrificed.

There are some reasons for believing that in due course of time the new therapy coöperating with and in some respects enlarging the old, and combining with the campaign for the early recognition of cancer, will actually decrease the recorded death-rate from cancer and thus attain very real economic importance. In the first place the actual five-year cures of several major forms of cancer, heretofore fatal, are now considerable in number and rapidly increasing. The fruits of improving technic are as yet hardly visible.

Then the prolongation of life in many cases only apparently cured gives opportunity for other causes of death to intervene and thus give a somewhat spurious diminution in the number of

cancer deaths. The importance of this factor is not to be depreciated, as it represents a distinct step in advance.

Most important is the fact that radiotherapy is a bloodless method, and while not painless it has no appreciable death-rate. Anyone who understands human nature cannot doubt that many more people will submit to radiotherapy than to the knife, and do it earlier. The treatment of many more suspicious or precancerous lesions will also be accomplished by the simple methods of radiation.

One serious obstacle stands in the way of prompt acceptance by the public of radiation treatment of early cancer and precancerous lesions, and this is the attitude of the medical profession toward the new therapy. It is, on the whole, a matter of congratulation that a method so revolutionary should have received such prompt recognition the world over. Only the most tangible and overwhelming evidence could have compelled this recognition. The rapid adoption of radiotherapy must stand as evidence of the intellectual honesty of the medical profession. Yet there is still an undercurrent of antagonism which reaches the public with much force, greatly impedes progress, interferes with the spread of knowledge, retards the acquisition of equipment and prevents many from receiving the benefits now available. For the same reasons, probably, the practise of establishing radiation therapy in municipal hospitals, quite general in Europe, has been adopted in America only by the city of Philadelphia, where it has been established through the wise forethought of Dr. Furbush. Yet it appears quite inevitable that other cities must follow.

The policy of concentrating the care of cancer patients in large institutions, fully equipped for all the methods now demanded in diagnosis and treatment, also appears to be justified. It is probably the most effective method of avoiding the apprenticeship which beginners in this work must inevitably encounter. When by these various means and adjustments efficient radiation is fully available to the public and intelligently accepted, there is little doubt that the death-rate will be appreciably reduced.

The other phases of the cancer problem, however, remain

unaffected by the new therapy. Extensive and advanced cancer will always be the discouraging problem of old. The need for a constitutional agent affecting the cancer process is still as urgent as ever, and apparently just as far from satisfaction. The task of unraveling the conditions of origin of the different forms of cancer, encumbered by the search for a single causative agent, has made little progress, but it may be stimulated by recent developments. From a most unexpected source, experimental physics, a new and powerful weapon has been brought into play, cancer research has entered on a new and practically fruitful era of therapeutics and more intelligent descriptive study, new territory has been conquered, the outlook for the cancer patient is improving, but the ancient enemy still sits grimly in his stronghold.

HEMATEMESIS

The Mary Scott Newbold Lecture

Lecture IX[1]

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I cannot adequately express my appreciation of the invitation to give the Mary Scott Newbold address before the College of Physicians of Philadelphia, and I shall therefore merely thank you most sincerely for the distinction you have accorded me.

"The Hippocratic school of medicine, as is well known, taught that the human body contains blood, mucus and yellow and black bile. Black-looking masses of blood in the vomited matters or in the stools, the dark color of which was due to their long retention in the stomach, were therefore regarded as black bile, and the disease of which this was the symptom was called melena or *morbus niger*, a full description of which is given in the second book of Hippocrates' *De Morbis*, p. 486. The vomiting of black blood was called *vomitus melancholicus* and was referred to the spleen, because this organ was supposed to secrete a *succus melancholicus coloris negricantis*. And so when the autopsy in cases of death from melena revealed an alteration in the form and color (black) of the spleen, the dependence of the black vomiting upon morbid conditions of the spleen seemed placed beyond doubt. But gradually the conviction began to gain ground that this dark matter discharged by vomiting or stool was neither a secretion from the spleen nor bile from the liver, but only altered blood.

[1] Read December 6, 1922.

This opinion, which is the one now accepted, was based upon the observation that the quantity of black vomited matter was too large to be regarded as a secretion of the liver or spleen, and, furthermore, upon the discovery in postmortem examinations that while the liver and spleen revealed no lesion, the same black matter which the patient had vomited during life could be seen, on the application of 'gentle' pressure to the walls of the stomach, to directly 'exude' from the gastric vessels. Finally, Portal subjected this *bilis atra* to a physico-physiological examination, and was led by various considerations, above all by the absence of any bitter taste, to the following conclusion: 'The black matter discharged by vomiting and stool, sometimes only by vomiting, less frequently only by stool, is not of the nature of bile, but is blood which acquired its black color in the alimentary canal, unquestionably because, being no longer in contact with oxygen gas, it becomes carbonated, and so forth.

"Thus by the beginning of the past century, 'black bile' had disappeared from pathology, and the *morbus niger* had been referred to the category of gastric and intestinal hemorrhages." (Von Ziemssen.)

Hematemesis is simple in its meaning but complex in its significance. The term is not synonymous with gastric hemorrhage, for although the stomach is usually the source of the bleeding, the blood may have its origin distant from the stomach and reach that organ either by being swallowed or regurgitated from the intestine. When large hemorrhages take place within the stomach, hematemesis does not necessarily follow, and serious and even fatal gastro-intestinal hemorrhages may occur without blood being vomited.

As a symptom, hematemesis presents some of the most baffling problems which confront the profession. Its causes are so manifold, so often difficult of detection, the indications for treatment so often uncertain, and the results of treatment so doubtful, that the subject is always of absorbing interest.

If a compilation of all the possible causes of hematemesis is made a very formidable list accumulates, but I shall not bore you

with an enumeration of all the diseases which may be associated with hematemesis or the conditions under which it may occur. A partial list will suffice to emphasize the wide variety of causes and to serve as a basis for the selection and discussion of some of the more important and interesting.

In a survey of the causes of hematemesis it is immediately evident that they may readily form two groups: those of known cause and those of unknown cause. Fortunately, by far the greater number fall into the first group, although it may be difficult to determine the cause. These known causes may be appropriately divided into two groups: intragastric and extragastric.

The intragastric causes may be ulcer, cancer, syphilis, tuberculosis, hemorrhagic erosions, gastritis in its various forms, benign tumors (polypi, angiomas, fibromas), linitis plastica, foreign bodies, operation on the stomach, caustics or aneurysm.

The extragastric causes may be duodenal ulcer, diseases of the liver (cirrhosis in its various forms) or biliary ducts (obstruction from stone, carcinoma or stricture); diseases of the spleen (splenic anemia, leukemia, hemolytic jaundice); diseases of the gallbladder, pancreas, appendix and the small or large intestine; cardiac and pulmonary disease; lesions of the mouth, throat, nose, pharynx or esophagus; nephritis and pelvic disease in women; disordered conditions of the blood (cholemia, chlorosis, purpura, melena neonatorum and hemophilia); acute febrile diseases (typhoid, scarlet fever and measles); vicarious menstruation; external traumatism and abdominal operations.

The unknown causes of hematemesis may all be grouped for the time being under the convenient term idiopathic, and include cases described by Hale White as gastrostaxis. The immediate causes of gastric hemorrhage are erosion or rupture of an artery or vein and capillary oozing from a congested mucous membrane. It has often been pointed out that it is seldom possible to estimate with accuracy the size of the bleeding vessel. Surgeons gradually abandoned emergency operations in hematemesis, because of this fact and because it was found that massive hemorrhages, indicating

the erosion of a large vessel, might occur and yet a most careful search of the gastric mucosa with specially constructed instruments fail to locate the source of the bleeding. It was finally learned that serious and even fatal hemorrhage could take place from an intact gastric mucosa, probably by true diapedesis, and the surgical treatment of hematemesis resolved itself into the diagnosis of the underlying cause of the bleeding and its treatment.

Gastric ulcer is by far the most common cause of bleeding from intragastric lesions. According to statistics on gastric and duodenal ulcer, hematemesis occurs in over 50 per cent of cases; more recent statistics show a much lower incidence. Patients with gastric and duodenal ulcer coming to operation in the Mayo Clinic gave a history of hematemesis in 25 per cent in the former and 20 per cent in the latter. These much lower percentages may be explained by the fact that formerly many patients were said to have ulcer solely because hematemesis had occurred, and also by the fact that both gastric and duodenal ulcer are now correctly diagnosed at a much earlier stage of the disease, so that complications formerly common, such as hemorrhage, perforation and obstruction, do not have the same opportunity to develop. The duration of the symptoms of gastric or duodenal ulcer coming under our observation has been about one-half the duration of symptoms in the cases seen fifteen years ago.

Hemorrhages associated with gastric or duodenal ulcer vary greatly in frequency, quantity and duration. A single hemorrhage may be so profuse as to be fatal, or repeated small hemorrhages of no immediate seriousness, or single hemorrhages of moderate amount at long intervals, may occur.

The relation of hematemesis to other symptoms of ulcer is not constant. The attack may occur or follow an exacerbation of symptoms, in which event there is usually complete relief of these symptoms. On the other hand, hematemesis from ulcer may occur without the warning of other symptoms and at times without the patient having had any symptoms of ulcer.

Inasmuch as there is a history of gross hemorrhage in 25 per cent of gastric ulcers and 20 per cent of duodenal ulcers, hema-

temesis must be regarded as a symptom of considerable diagnostic importance. Although there are numerous other causes for gastric hemorrhage, the first cause to exclude in any case of hematemesis is peptic ulcer. The necessity for this is now well recognized, because surgical experience has shown that gastric hemorrhage, even when associated with suggestive symptoms of ulcer, does not necessarily mean that ulcer is present, and many unnecessary, futile and discrediting operations have been performed on the assumption that an ulcer was present.

The treatment of gastric or duodenal ulcer associated with gastric hemorrhage involves the question of the most effective method of dealing with such ulcers, as well as the most favorable time for carrying out such measures. Internists and surgeons, whatever their differences of opinion with regard to the management of ulcer, find themselves in agreement on the advisability of surgical treatment for those ulcers in which repeated hemorrhages have occurred. While the surgeon believes that chronic ulcer of the stomach or duodenum, even though not complicated by hemorrhage, is a surgical condition, a history of hemorrhages not only makes operation unquestionably advisable, but demands that the ulcer be dealt with by radical removal, and makes postponement of such treatment contrary to the best interests of the patient.

If the patient is to be protected against further bleeding, therefore, surgical treatment must include the removal of the ulcer. In a paper on this subject, in 1919, I showed that 13 per cent of the patients who reported hemorrhage before operation had hemorrhage after operation (in two patients sufficient to cause death), while of the patients who did not report hemorrhage before operation, only 0.9 per cent reported it after operation. The lesson in this connection is illustrated by the fact that of the 83 cases in which hemorrhages occurred after operation for duodenal ulcer, in not a single instance had the ulcer been excised at operation, and in only 1 of the 17 cases in which bleeding had occurred after operation for gastric ulcer had the ulcer been excised. It may be pointed out that the usual history in these cases is that the

patients were completely relieved of all symptoms by the operation, and that the hemorrhage occurred without any warning. It became clearly evident, then, that radical removal of the bleeding type of ulcer is essential, and we have adopted the practice in all such cases, carrying out radical measures whenever reasonably possible. Under such treatment occurrence of hemorrhage following operation has been reduced to its minimum. It must again be pointed out, however, that gross hemorrhages may take place from an intact mucous membrane, either independently of an ulcer in the stomach or in the absence of ulcer. Hence, the possibility of the bleeding following operation for ulcer being due to causes other than ulcer must always be kept in mind.

Of the methods of dealing with such ulcers, cautery deserves mention. In small bleeding ulcers on the anterior wall of the duodenum, simple puncture with cautery effectively destroys the ulcer area, this treatment being followed by a gastroenterostomy. Ulcers on the posterior wall of the duodenum cannot be as easily dealt with, particularly if large and adherent, and the added risk of excising such an ulcer is only justified when the ulcer is associated with hemorrhage. Pyloroplasty, particularly by the method of Finney, is a very useful operation in bleeding duodenal ulcers. It not only easily includes excision of an ulcer on the anterior wall, but inspection of the posterior wall, and there is no doubt that recurring hemorrhage following operation for an ulcer of the anterior wall of the duodenum may be due to an undiscovered ulcer on the posterior wall. We have met with over 230 (4.27 per cent) cases of multiple duodenal ulcers in the Mayo Clinic, and undoubtedly we have overlooked a considerable number. Fortunately, the operation of gastroenterostomy when performed for a visible ulcer on the anterior wall is just as effective for a concealed ulcer in some other portion of the duodenum.

It is even more important that bleeding ulcers on the gastric side of the pylorus should be radically dealt with, for not only may an unremoved ulcer of the stomach be the cause of subsequent hemorrhages following an indirect operation, but such ulcers are unquestionably potentially malignant. The methods of dealing

with them are either excision by cautery or knife combined with gastroenterostomy or by partial gastrectomy. Most American surgeons have adopted the rule that when a gastric ulcer is small and readily mobilized, local excision followed by gastroenterostomy should be performed; when it is large and indurated, partial gastrectomy should be the first choice, unless this operation is contraindicated by local conditions which may add prohibitive risks to the operation.

The proper time for surgical interference in ulcers complicated by hemorrhage is now generally agreed on in this country. The late Dr. Rodman pointed out the inadvisability of operation during hemorrhage. This is true for three reasons: First, the patient is not in good condition for operation; second, the emergency of the situation does not permit a differential diagnosis; and third, recovery is the rule. The custom has therefore developed in this country of carrying the patient through the active hemorrhage by absolute rest, morphin, ice and transfusion, and at the earliest favorable time to deal with the ulcer by surgical means if an ulcer has been proved to be present. Transfusion not only restores the quantity of the blood but increases the clotting elements, yet it must be intelligently advised, as it may give a false sense of security and may even cause the reopening of a vessel wall which has been closed by a clot. We seldom employ transfusion in bleeding ulcer, except in those cases in which repeated small hemorrhages are occuring or only when immediate operation is to be performed or when we know that the source of the bleeding is controlled. While operation during or immediately following a first large hemorrhage is not advisable, experience has shown that if another hemorrhage occurs in three, four or five days succeeding the first an emergency operation should be performed; the bleeding should be regarded as a secondary hemorrhage and managed as such; that is, by exposure of the bleeding point, ligation by suture of catgut or excision of the ulcer by cautery, if the condition of the patient permits. If operation is not undertaken during the second hemorrhage the probability is that another hemorrhage will occur when the blood-pressure becomes sufficiently restored and cause

the death of the patient. Occasionally, although very rarely, therefore, a patient succumbs to a hemorrhage from ulcer who might have been saved by an emergency operation. It is of interest to note the revival by Finsterer, of Vienna, of this question of operating on ulcers during the time of bleeding. He advocates prompt operation when hemorrhage occurs, performing, as a rule, partial gastrectomy, and reports a mortality of 5.5 per cent when the operation was performed within the first forty-eight hours, but after an interval longer than this a mortality of 29 per cent. I believe, however, that American surgeons will be slow to subscribe to his method of dealing with bleeding ulcer, because the danger of succumbing to hemorrhage is less than the danger of operation during hemorrhage. Medical management is usually preferable during the first hemorrhage, and should be continued until the patient is in satisfactory condition for operation.

Cancer of the stomach is rarely associated with hematemesis. Bleeding, however, is common, but not in sufficient quantity to be vomited, and it is a continuous oozing such as occurs in cancer of the rectum or uterus. Evidence of this continuous oozing, which is referred to as occult hemorrhage, was formerly sought for and greatly relied on as a diagnostic aid in malignancy of the stomach and in benign ulceration; but the possibilities of erroneous interpretation were so great, particularly in ulcer, and the significance of occult blood so often confusing, that its value in relation to other symptoms is not of great importance. While the search for occult blood in the diagnosis of upper abdominal disease has now, I believe, been rather generally abandoned, it should be remembered that occult blood is practically always present in gastric cancer and should be of diagnostic value in patients beyond middle life with gastric achylia, secondary anemia and a negative fluoroscopic examination. Cancer of the anterior or posterior wall in the cardiac end of the stomach is very difficult to visualize by fluoroscopy, because of the difficulty of sufficiently distending the stomach with bismuth.

Rarely, however, cancer of the stomach may be complicated by hemorrhage in sufficient quantity as to cause death. I have

seen a patient with cancer of the stomach, while waiting in the hospital for operation, succumb to gastric hemorrhage, and at necropsy found that malignancy had invaded the pancreas and eroded a large branch of the pyloric artery. Recently, in the Clinic, partial gastrectomy was performed for cancer of the stomach in a patient who three weeks before had suffered from a hemorrhage which had almost cost him his life. There is, however, with few exceptions, little diagnostic value or helpful therapeutic indication in gastric hemorrhage associated with cancer. If the disease is in an operable stage, it is sufficient reason for immediate operation. Gross hemorrhage from the stomach occurred in gastric cancer in 8 per cent of the cases seen in the Mayo Clinic, in gastric syphilis in 5 per cent of the cases and in benign tumors in 9 per cent. In one patient with a large angioma of the greater curvature of the stomach we were able to perform a partial gastrectomy under local anesthesia, with no recurrence of the bleeding.

Operations on the stomach may be the cause of hematemesis. Hemorrhage into the stomach in sufficient amount to be vomited may take place after any operation on the stomach. It is probable that such postoperative bleeding is always due to avoidable causes. If the operation has been for ulcer and the ulcer has not been removed, the ulcer may be and has been the source of the hemorrhage. Although bleeding from an unremoved ulcer is extremely rare, if it does occur it may be regarded as avoidable, because, except in exceptional cases, the ulcer should have been excised. The principal cause of hemorrhage following operation on the stomach is from the cut edge of the stomach or intestine. Experience in the Clinic leads us to believe that serious bleeding of this nature is avoidable. I can recall cases of serious hematemesis following gastric operations, but with improvement in technic this complication has largely disappeared. The independent ligation of all vessels of any size, the care with which the continuous suture is used in the anastomosis, the habit of loosening clamps for inspection before the anastomosis is completed and excising the ulcers more often, are the chief reasons for the disappearance of postoperative hematemesis.

It should be taken for granted, then, that bleeding after gastric operations is probably due to some error in technic and could have been avoided. While this is theoretically true, yet even with the most scrupulous care in conducting operations on the stomach, vomiting of blood may occur. While this is usually in small quantity, it is alarming to the patient, the family and the surgeon. Secondary exploratory operations have usually proved to be unnecessary and unsatisfactory in such cases, for even if the stomach is opened it is practically impossible to find a bleeding spot on which a successful attack may be made. We have found that these hemorrhages cease with falling blood-pressure, morphin, absolute rest, the removal of clots from the stomach by means of the stomach tube, and irrigation of the stomach with water of 120° F.

Extragastric Causes of Hematemesis. Cirrhosis of the liver easily stands first in frequency and importance. It has long been recognized that hematemesis may be due to hepatic cirrhosis even when there are no other recognizable signs of changes in the liver. Rolleston has referred to such cases as latent cirrhosis. There is so much evidence to show that these are dependent on some infectious process for their development, that the question to be kept constantly in mind is, what is the source of the toxin on which this infectious process depends? Any toxic focus from which the venous blood is delivered directly to the portal circulation could theoretically produce an infectious process in the liver sufficient to produce cirrhosis. There is ample clinical evidence to support this view. Graham has also shown that hepatitis almost constantly accompanies chronic disease of the gall-bladder and pancreas and that in chronic cholecystitis, the liver, microscopically, often presents a picture practically identical with that of early cirrhosis.

It has also been pointed out by various observers that the spleen is particularly liable to set up cirrhotic changes in the liver, with the sequence of events as follows: The spleen acts as a sieve in catching and destroying pathogenic bacteria; these bacteria may be of such a character or number that the spleen becomes per-

manently disabled in its function, and although the bacteria responsible for the original infection have disappeared, the spleen, because of its intimate connection with the liver anatomically and physiologically, may deliver directly to the liver through the splenic vein, toxins which sooner or later set up cirrhotic changes in that organ. When this has occurred, splenectomy removes a true focus of infection with arrested progress of the cirrhosis, unless it has already become advanced. The point I would emphasize in connection with cases of hematemesis due to supposed latent cirrhosis is that the hemorrhages are due to some primary pathologic condition elsewhere in the body, and the spleen, because of its close association with the liver, should always be taken into consideration. The following case illustrates this point:

Case 97895.—Mr. C. W. E. S., aged forty-five years, came to the Clinic, December 20, 1913, with a history of having had repeated gastrointestinal hemorrhages. The symptoms were suggestive of ulcer because of the chronicity and periodicity of the digestive disturbances, of which the patient complained, but fluoroscopic examination of the stomach was negative. Nevertheless, chronic duodenal ulcer of the bleeding type was the first diagnosis, and an exploratory operation was performed.

No ulcer could be demonstrated, but a marked varicosity of the veins at the pylorus, and for some distance along the lesser curvature, was present. The gall-bladder contained a stone impacted in the pelvis, and there was marked pancreatitis. The gall-bladder was removed, and several of the veins at the pylorus were ligated.

The patient returned to his home, but very soon he had two severe hemorrhages, and returned to the Clinic. It was then believed that an ulcer had been overlooked.

Another exploration was performed, and although an ulcer could not be definitely discerned, it was thought that in view of the hemorrhages, the digestive disturbance and the adhesions around the pylorus that a gastroenterostomy would be justified. This

was performed, and for about a year the patient had no hemorrhages. They then recurred, and a further exploration was made on the assumption that a new ulcer had developed in the line of anastomosis or that the supposed original ulcer was still active. Careful inspection of the mucosa of the stomach did not reveal ulceration, but an extremely congested mucous membrane.

The patient went home, but returned to the Clinic three months later, having had several hemorrhages, with both hematemesis and melena. He was in a serious condition; repeated vomiting of small quantities of blood and continual melena had reduced the hemoglobin to 27 per cent. For the first time the spleen was considered as a possible factor in the hemorrhages, although it had not been reported as being enlarged at any of the previous operations. I removed the spleen, which was about one and one-half times normal size. The patient recovered from the operation; he is now in perfect health, and there has been no evidence of gastric or intestinal hemorrhage since his operation in 1916.

The next common causes of hematemesis due to extragastric lesions are certain diseases of the spleen. Splenic anemia is not only the most common disease of the spleen, but it is also most often associated with gastric hemorrhage. Of 74 splenectomies for splenic anemia in the Clinic, 37 (50 per cent) of the patients gave a history of one or more gastric hemorrhages. Such hemorrhages may be so profuse as to be fatal. The mechanism by which they are produced is probably due either to the intimate relationship of the blood supply of the spleen and stomach or to the hepatic cirrhosis which so often accompanies splenic anemia, or to both. Forty per cent of the blood of the splenic artery passes to the stomach with a corresponding return through the vasa brevia veins. Thrombophlebitis of the splenic vein is common in splenic anemia, so common, in fact, that it is considered by certain observers as the chief etiologic factor in the disease, and the venous obstruction incident to this produces an intense engorgement of the mucous membrane of the stomach, particularly of the cardiac

end. Gastric bleeding, as Osler pointed out, in such cases may be due, then, to (1) general diapedesis from the gastric mucosa, (2) small erosions of the gastric mucosa, (3) rupture of a varicose vein of the esophageal plexus, or, (4) as Rolleston suggested, torsion or kinking of the splenic vein, because of traction on the gastro-splenic omentum. The explanation that the gastric hemorrhages in splenic anemia are due to mechanical causes would be readily acceptable were it not for the fact that in other diseases of the spleen in which splenomegaly is extreme, such as hemolytic jaundice and myelogenous leukemia, hemorrhages are exceedingly rare.

As a matter of fact, in a series of 45 splenectomies for hemolytic jaundice we have not met with a single case in which there was a history of hematemesis. In myelogenous leukemia only 1 per cent of our patients reported hematemesis. The striking difference in the pathology of the spleen in splenic anemia and in diseases associated with splenomegaly is the evidence of a chronic infectious process in the former and the absence of it in the latter. The surgeon finds, in removing the spleen in splenic anemia, that widespread indications of chronic inflammatory changes exist. The spleen itself is often fixed in a mass of adhesions, sometimes so firm and so inaccessible that the operation is difficult and hazardous. Furthermore, as I have mentioned, thrombosis of the veins from the spleen, especially the splenic vein, is common.

The pathology of the spleen in splenic anemia is characterized by marked fibrotic changes, thrombophlebitis and destruction of splenic pulp. Chaney, who has recently made some very interesting investigations in this connection, says that "the spleen seems to act as a large lymph node by removing toxic materials and even bacteria from the blood stream. In the conflict between this harmful material and the spleen a certain amount of splenic pulp is destroyed and is replaced by fibrous tissue. In a disease such as splenic anemia the spleen seems to be called on to destroy more of the toxic material than is possible, for in these cases there is a very early hepatitis which would seem to indicate that some of the infection had spread to the liver. This process is a slow one, for

the disease continues for many years. Finally, so much of the useful splenic pulp is destroyed that the spleen can no longer dispose of the bulk of the infection. The spleen may then be said to be in a state of decompensation, and it becomes a menace by serving as focus from which the liver may more easily be attacked.

"In splenic anemia, if the spleen serves a useful purpose up to a certain stage of the disease, there must be an optimal time for splenectomy. A liver functional test may sometimes be discovered which, in furnishing information concerning the liver, may serve indirectly as an index to the function of the spleen. A study of the postoperative mortality in these patients indicates that splenectomy for splenic anemia should not be delayed until well-marked hepatic cirrhosis has occurred."

These conditions do not exist in such a degree in other splenomegalies, and they lead to the conclusion that causes other than mechanical are responsible for the gastric hemorrhages; the fact that cirrhosis develops sooner or later in splenic anemia at least suggests that such hemorrhages occur through the medium of the liver.

The liver and spleen, then, are responsible for the majority of gastric hemorrhages due to extragastric causes. Time will not permit comment on all the numerous extragastric causes of hematemesis, and I shall only refer to a few others which are of especial interest.

Chronic jaundice, whether its cause is intrahepatic or extrahepatic, predisposes to hemorrhages from mucous membranes, including the stomach. In those cases in which the underlying cause of the jaundice can be corrected by treatment, medical or surgical, it is most important that the tendency to hemorrhage, because of the dissolution of the blood corpuscles and the changes in the wall of the capillaries, should be controlled. Many methods have been suggested, but none with more than indifferent success. Recently, Walters, following the recommendation of Lee and Vincent, has been able consistently to reduce the coagulation time of the blood by daily intravenous injections of 5 cc of 10 per cent of calcium chloride solution for a three-day period. The

results of this treatment have been so effective that we have lost the anxiety with which we conducted operations on patients with marked jaundice.

Gall-bladder disease, particularly when associated with pancreatitis, may be associated with hematemesis. We have seen a number of such cases in which the results after operation leave no other conclusion than that the lesion in the gall-bladder or pancreas, or both, was responsible for the hemorrhages. Eusterman says that 4 per cent of the patients with gall-bladder disease characterized by well-marked, reflex gastric disturbances gave a history of hematemesis. The following case illustrates this group:

Case 132411.—Mr. J. A. S., aged fifty-five years, came to the Clinic, June, 1915. He had had a gastroenterostomy performed eleven months before for gastrointestinal hemorrhages supposedly due to a bleeding ulcer. Following the operation, he had had many attacks of hematemesis and melena. The longest period of freedom from bleeding was seven weeks.

Exploration of the stomach, through a large incision in its anterior wall, revealed a congested mucous membrane that bled at the slightest touch, but no ulcer could be demonstrated either in the stomach or in the anastomosis. The pancreas, however, was large, nodular and hard, and there was marked cholecystitis of the strawberry type and chronic appendicitis. The gall-bladder and appendix were removed; the patient made a good recovery, and has had no signs of hemorrhage since.

The appendix is another example of an extragastric intra-abdominal lesion being, apparently, the causative factor for hematemesis. A number of observers have reported such cases, and we have seen in the Clinic a series of cases in which the history, the findings at operation and the results of operation could lead to only one conclusion: That the appendix was in some way responsible for the gastric hemorrhages. The following case is representative of this group:

Case 252840.—Mr. F. S., aged forty-seven years, came to the Clinic, December 7, 1918. For seven years he had complained of epigastric distress, two or three hours after meals, with partial relief by food and complete relief by bicarbonate of soda. These spells usually lasted two or three months. In the first spell he had seven hemorrhages from the stomach; in one of these he vomited at least a quart of blood; five hemorrhages occurred during the second spell and three in the spell previous to his visit to the Clinic. The blood was bright red in all of the attacks and was also associated with melena. Although fluoroscopic examination was negative, the preoperative diagnosis, because of the gastric syndrome, associated with hemorrhage, was ulcer.

At operation, careful exploration of the stomach and duodenum did not reveal ulcer; the spleen, liver, gall-bladder and pancreas were all apparently normal, but well-marked appendicitis was found and the appendix was removed. It is now three years since the operation and the patient has had no evidence of hemorrhage.

We have seen a considerable number of similar cases, with disturbance of digestion suggestive of ulcer, in which hematemesis was the most prominent feature, and on exploration have found some well-defined extragastric lesion, most often in the gall-bladder or appendix or both. The results which have followed the removal of these lesions seem to support the belief that they were the causative factors.

Since it is established that chronic infectious processes within the abdomen may be responsible for gastric hemorrhages, the question naturally arises: In what manner are such hemorrhages brought about? I have suggested that the liver is the key to the explanation, and that the changes which result in hemorrhages are produced through the same channel in all, namely, the portal circulation. It is known that hepatic cirrhosis is a common cause of hematemesis; that it is, as Adami has pointed out, often toxic in origin; that a large part of the blood of the body is transmitted through the liver, and that toxic foci associated with gastric hemorrhage may exist, especially in the abdomen. Is it not

possible that these various chronic foci of infection cause chemical or physiologic changes in the liver, changes which, if the cause is not eradicated, may progress to the cirrhotic liver? And is it not also probable that the liver under such circumstances may in some manner sufficiently lower the resistance of the gastric mucosa to permit bacteria, which are consistently present in true gastric ulcer and in mucous erosions, and which may reach the stomach either by the blood stream or by the food, to set up those diffuse or localized tissue changes which may culminate in hemorrhage? In other words, it is probable, in many of these gastric hemorrhages in which the causative focus is established, that the conditions which result in hematemesis are largely under the control of the liver; and since the spleen is so intimately concerned in the function of the liver, it, too, must be regarded as an important factor.

The remaining extragastric causes of hematemesis are rarities, and chiefly of interest from the standpoint of diagnosis and the danger of overlooking these rare causes. Misinterpretation of swallowed blood from an early pulmonary tuberculosis, or varicosity in pharynx or esophagus, unrecognized cardiac disease, and the assumption that hemorrhage in chlorotic young women means ulcer, might be mentioned. We have recently seen in the Clinic two remarkable cases illustrating gastric hemorrhage occurring in hemophiliacs.

Case 406581.—Dr. M. L. L., aged thirty-two years, entered the Clinic, October 12, 1922, complaining of weakness and burning epigastric pain, coming on one or two hours after meals, lasting until the next meal or until relieved by taking food or bicarbonate of soda. Considerable pyrosis was present, with belching of gas, nausea and occasionally induced vomiting when the distress became too severe.

Posterior gastroenterostomy for bleeding duodenal ulcer was performed elsewhere, November, 1919, followed by complete relief for eighteen months. Then the patient gradually developed hyperacidity and a return of the epigastric distress with tendency to abdominal rigidity. In August, 1921, he had tarry stools

for several days, followed by a profuse gastric hemorrhage, hematemesis for two days and reduction of hemoglobin to 28 per cent, requiring transfusion of 500 cc. He lost twenty-five pounds in weight in one month. In November, 1921, a second operation was performed, the old ulcer being cauterized. Gradually the old symptoms returned, and in April, July and August, 1922, tarry stools were noted. In August, tarry stools continued for two weeks, and he became so weak he was forced to remain in bed for a period of two weeks. Then he gradually improved and began to gain weight, strength and color. When he came to the Clinic, in October, 1922, he showed chiefly the evidences of a secondary anemia. Tonsillar and dental infection were present, and he was advised to deal first with these foci of infection.

While waiting for treatment the patient received a letter from his brother stating that he had a gastric hemorrhage following a football injury. This brought up the question of possible hemophilia, which had previously been denied in the family history. After much questioning it was learned that three brothers, one nephew, one male cousin and possibly an uncle gave histories of bleeding.

Case 407582.—Mr. H. L., aged twenty-one years, brother of the preceding patient, came to the Clinic, October 12, 1922, and gave practically the same history of bleeding duodenal ulcer with hematemesis and tarry stools, for which a posterior gastroenterostomy was performed elsewhere, November, 1921. Four months later the symptoms returned with shorter intervals of freedom. Six-weeks before his examination in the Clinic, another hemorrhage had occurred, with melena for three days, after which he was greatly prostrated. A transfusion of 500 cc was then given, followed by gradual steady improvement. He, too, was certain of no hemophilia in the family.

We must refer finally to a group of mysterious hemorrhages about which much speculation has been offered, namely, the idiopathic hemorrhages or those which Hale White termed gastro-

staxis. About twenty years ago the existence of such a group was pointed out by various observers, particularly Hale White of England, and Rodman of this country. This was a timely observation, for it showed that a diagnosis of ulcer in chlorotic girls, because of hemorrhages, was usually erroneous, and that the bleeding was not due to ulcer. The term "gastrostaxis" was applied by Hale White to these idiopathic hemorrhages.

I have tried to point out in this paper that many of these unexplained hemorrhages are due to causes which can be recognized and satisfactorily dealt with. If it is true that foci of infection in various parts of the body, particularly the abdomen, may, through the liver, be responsible for gastric hemorrhage, it would seem likely that the occurrence of an unexplained hemorrhage will utimately become a reflection on our diagnostic ability.

APPENDIX.

PROCEEDINGS

OF THE

SECTION ON OPHTHALMOLOGY

JANUARY 19

Pseudopterygium and Symblepharon Corrected by Teale's Operation

Dr. Charles R. Heed exhibited a male patient, aged thirty-four years, electrician, referred to the Jefferson Hospital, in the service of Dr. H. F. Hansell, August 1, 1921. Eighteen months previously the left eye had been severely burned with acid. The patient had suffered constantly with diplopia and exposure keratitis as a result of the adhesions. Examination revealed an extensive symblepharon. Two-thirds of the upper lid conjunctiva, from the inner angle outward, was adherent to the globe by dense cicatricial tissue, and the adjacent cornea was covered for one-third of its area by a dense, vascular pseudopterygium. The patient stated the adhesions had been severed twenty-one times without relief.

The following day, under cocain anesthesia, the cicatricial tissue was incised at the limbus, dissected entirely free from the globe, and a flap of conjunctiva from the upper and outer portions of the

globe turned and sutured over the upper exposed half of the defect. A similar flap, from the lower part of the ball, was sutured to cover the remaining exposed area. The margins from which the flaps were taken were then brought together. After healing the patient could readily close the lids, had no diplopia and practically no irritation. The cosmetic effect is better than expected, due to the atrophy of the tissue forming the pseudopterygium.

Atrophy of the Iris

Dr. Frederick Krauss presented a girl, aged four years, in whom the iris pigment had been absorbed in the lower half, the lower pupillary edge of the iris being replaced by a broad crescent of white connective tissue adherent to the anterior capsule of the lens. A good reflex was obtained through the pupil and the remaining iris stroma below. No view of the fundus could be had on account of apparent fine capsule haze. V = light perception.

The child five weeks after birth had a fine general haze of the cornea of the right eye, from which there was perfect recovery. Fourteen months later a large hemorrhagic exudate appeared in the anterior chamber of the left eye associated with inflammatory symptoms. The cornea became hazed in two-thirds of its extent, but the mass gradually became absorbed and the cornea cleared. Below the pupillary space some of the exudate organized into scar tissue, flat against the lens. The child has been unusually healthy. The family history is negative, especially as to tuberculosis and syphilis. The laboratory tests are negative. The hemorrhage was apparently spontaneous.

Sclerosis of the Choroid

Dr. Luther C. Peter exhibited W. M., aged fifty-two years, who had failing vision for about ten years in the left eye. When a child he was struck in the right eye, the injury probably explaining the presence of a shrunken capsule, the remains, probably, of a traumatic cataract. The capsule is detached above and

falls back toward the vitreous body, but over the top the fundus is visible. The disk is small and atrophic, dirty yellow in color; arteries and veins are much contracted. The retinal pigment has undergone absorption and is deposited in spider-like areas throughout the fundus, for the most part distributed along the vessels. The choroidal circulation is plainly visible, and in the region of the disk consists mostly of white lines of varying thickness, which assume more nearly the appearance of the normal choroidal circulation toward the equator.

In the left eye there is a central lenticular opacity, and the same general fundus picture is the same as in the right eye, although the sclerosing process is not so complete. Through a red light filter (Wrattan filter) the choroidal circulation is particularly well defined.

Although a venereal history is denied by the patient, he has a +3 Wassermann. The fields are contracted in both eyes and the color fields are almost as large as form. Vision has been improved and the fields are as large today as they were three years ago, when he first came under observation.

The condition is a sclerosing of the choroidal circulation, with atrophy of the retinal elements and of the optic nerve. The etiology is probably lues.

Three Cases of Leber's Disease, with the Family Tree Covering Four Generations

Dr. Luther C. Peter presented three cases, typical examples of Leber's disease, or familial atrophy, in a brother, a sister and the son of the sister. Out of twenty-three descendants for four generations fifteen have suffered from the disease.

So far as can be learned there has been more or less uniformity as to age, mode of onset and subsequent history in each generation. The onset was usually sudden, between the ages of fifteen and twenty years. In each of the cases presented vision was so much disturbed that the patients were led around for several

months. Then followed improvement and return of peripheral and partial return of macular vision, which, so far as can be determined, has remained in *status quo* throughout life or with very slight subsequent loss, with two possible exceptions, which will be noted. Macular vision remained permanently damaged, at least to some extent, in each case. In two cases vision subsequently diminished in acuity. It is alleged that one young man, aged twenty-two years, lost his sight completely just before death, which was caused by pulmonary tuberculosis; the other case is one of the third generation, whose vision rapidly grew worse after each alcoholic excess, to which he was addicted, and it is said that he now has little sight left.

The fundus appearance is similar in each of the three patients. The disks are grayish white, fairly well outlined and the cribriform membrane is plainly visible. Arteries and veins are reduced in size but not so small as observed in secondary postchoroidal or postretinal atrophy. The disk is not so clear as in primary atrophy. Beyond the disk, changes are not marked.

In the case of the sister and her son careful studies have been made. The Wassermann is negative, roentgen ray of the sella turcica shows no unusual enlargement and the sinuses are practically normal. The son is somewhat feeble-minded, but apart from this condition the neurologic report of Dr. Theodore Weisenburg is negative. In so far as our studies have gone the cases are interesting in a negative way. Form fields show little contraction. The blue and the red are somewhat contracted; green, however, is not recognized as green, excepting in small areas close to the point of fixation. In each of the three cases there is a central scotoma varying from an indistinct to relative and absolute and of varying size.

Dr. Peter referred to the points of greatest interest in Leber's disease as the etiology and the character of the atrophy, and mentioned the various theories advanced, and said that, from the evidence thus far produced, although perhaps vague and inconclusive, it is probable that the solution of the etiology of this singular disease will be found to be a manifestation of an hereditary type of disturbance of the internal secretions.

Sarcoma, Glaucoma and Complicate Cataract

Dr. S. Lewis Ziegler presented a patient, aged forty-one years, exhibiting so many unusual complications as to deserve the designation of a "pathologic mine." There was a history of sarcoma of the forehead and supraorbital tissues, first excised by an osteopath in 1918, leaving exposed frontal sinuses which did not heal. The tumor rapidly recurred in a much enlarged and more malignant type. In 1919, Dr. W. L. Clark removed all traces of the growth by inserting a series of small radium needles, about one inch apart, and allowing them to remain twelve hours. The seances were twice repeated. Since that time, now more than two years, no recurrence has been noted. There is some dermal exfoliation, and a few petechiæ are scattered over the surface of the skin.

O. D., absolute glaucoma, with the possibility of sarcomatous metastasis, caused a decision in favor of enucleation. Section of the globe shows a glaucomatous cup and soft opaque lens, but no tumor.

O. S., vision 20/40, J. 3. During January, 1921, her father's death caused grief and crying. On February 2, stinging pain in O. S. followed by blurred vision; small hemorrhage in the anterior chamber; vision 20/70, T + 1. Fields for form and color contracted; pupil not dilated. On February 8, while examining the eye, a spurting hemorrhage from the iris was observed. On February 10 a posterior sclerotomy was performed, as both trephining and iridectomy seemed inadvisable. Slight hemorrhages occurred, both in the anterior and vitreous chambers. The Parinaud incision was performed with a broad Graefe knife, the blade being rotated at right angles and a V-shaped incision made. Although the wound was carefully closed lacrimal infection occurred, the exudate visibly covering the ciliary body during the next thirty-six hours. An injection of mixed infection phylacogen was given, followed by seven others on alternate days. The infection gradually subsided, leaving a slight haze of

the posterior capsule, which later developed into a soft cataract similar to the other eye. The glaucoma was kept under control by eserin and negative galvanism. The scleral incision bulged slightly and tension finally became normal, but the pupil was somewhat irregular.

As the light field was excellent, at the end of eight months complete V-shaped discission of the lens was done on October 24, 1921, since which time the lens has been undergoing gradual shrinkage from above downward. There has been no rise of tension. A test with Sph. + 10 D. yields a vision of 5/200 by looking through the clear area above. The previous plastic capsulitis has made convalescence slow.

Concerning Certain Complications Associated with the Todd Tucking Operation

Dr. Harold G. Goldberg described several complications which he had met with in the performance of the "Todd Muscle-tucking Operation." His purpose in treating this subject was not so much because of the importance of the Todd operation as that he attempted to prove that all operations upon the muscles of the eye which had for their object a shortening of the tendon produced strangulation of the blood supply of the muscle because of the manner in which the sutures were applied. This point was brought so forcibly to his attention in connection with the Todd operation, which in one case produced complete strangulation and sloughing, that he thought it was important to bring the matter to the attention of the Section for discussion.

Dr. J. Milton Griscom said he had used the Todd tucking operation exclusively during the past two years and found it more satisfactory than any other method. In the last 15 consecutive cases 10 were completely successful, 3 partially so and 2 were failures. He had not seen any bad effect from strangulation of the muscle, as reported by Dr. Goldberg, but he considered it an important point against the operation, which may be responsible for many failures which we attribute to other causes.

Dr. William Campbell Posey said that he had never employed the tucking operation on account of the possible strangulation of the muscle which it might entail. Laterally he had made use of a twin single-stitch operation, by means of which the muscle and superlying conjunctival and tendenous tissues were brought forward as close to the cornea as possible by two mattress sutures symmetrically inserted through the upper and lower halves of the muscle. His results were better by this procedure than any other he had previously employed. There was but little reaction on account of the slight incarceration of the tissues by the sutures, and the removal of the stitches was extremely simple. Dr. Posey dwelt upon the desirability of approximating the flap containing the tissues to be advanced to the site of the sutures buried in the capsular tissue, by forceps, before tying, to prevent the sutures cutting their way out through the tissue from undue dragging.

Dr. William Zentmayer said for several years he had practised the O'Connor method of tendon shortening, but felt compelled to abandon it because of certain disturbing complications that frequently resulted. In the cases in which there were no complications his results were better by this method of operating than by any that he had heretofore or since used. In one of the 3 cases operated upon by O'Connor himself at Wills Eye Hospital there was an excellent immediate result, but several weeks later the patient returned stating that he had felt a sudden snap in his eye. Upon examination it was found that the tendon had given way and that he had what might be termed a complete traumatic palsy with a squint which was much greater than it had been originally. This same accident occurred in one of Dr. Zentmayer's cases while the patient was still in the hospital. A second complication, and one which compelled him to abandon the operation, was the frequency with which a peripheral corneal ulcer opposite the advanced tendon occurred. The first complication undoubtedly was the result of necrosis of the lateral strands and the second was the result of interference with nutrition of the cornea by the large mass of catgut which is left in place in this method of operating. He understood that this complication also

occurs at times after tucking operations. He stated that the interference with the blood supply cannot explain the results obtained in the several methods that have been spoken of, as it is the tendon alone and not the belly of the muscle which is involved. He believed that our failures result entirely from poor scleral anchorage, resulting in part from the fear of injury to the ciliary body by the needle.

Wells, of Boston, made some animal experiments which went to show that even in the most carefully performed operations of this nature in the great majority of cases the needle either grazed the surface or goes into the outer surface of the ciliary body. Indeed, Denig, about twelve years ago, advised passing sutures obliquely through the cornea and through the extreme angle of the anterior chamber. With proper operating-room technic we need not fear the results from the needle accidentally injuring the ciliary body.

Dr. Luther C. Peter said the tucking operation for squint is not nearly so satisfactory an operation as advancement of the muscle. A carefully performed advancement or resection always yields best and most satisfactory results. If, however, a tucking operation is undertaken the single suture, as originally practised, passed through the center of the muscle cannot do otherwise than constrict the circulation. Instead of this single suture more satisfactory results can be obtained by two sutures—one passed through the upper third and the other through the lower third, leaving the central muscle fibers free.

He had never had a tucking operation to fail, either from constriction of the circulation or from subsequent slipping of the tendon. While it is an operation which is easy for the beginner to perform, it will not yield the uniformally good results that one should obtain with a Worth advancement.

Dr. Burton Chance protested that the surgical procedures described by Dr. Goldberg and the other speakers are not technically those of Todd's "tucking operation," indeed, certain of the annoying after-effects described followed the use of an instrument altogether different from Todd's appliance. Moreover, Dr. Chance stated, Todd had no such effects following the use of his pronged

instrument, because he did not secure the several layers of the muscle by a stout double thread, of rather heavy catgut, inserted in the middle of the folds of tissue, by which the muscle is likely to be strangled. On the contrary, Dr. Todd inserted two threads, one near the upper and one near the lower border, between the prongs of the tucker, and then tied them, thus leaving the middle third uncompressed. Dr Chance said he used the tucker with satisfaction, yet he does not charge any lack of success he might have had to Dr. Todd's method, as he had not followed the method as Dr. Todd described it.

Dr. S. Lewis Ziegler remarked that Dr. Posey, by passing his suture farther back, drew the capsule forward and thus adopted the principle that he had advocated in his capsulomuscular advancement, only he used a single double-armed suture where Dr. Posey used two. The same view was held by de Wecker and Knapp, both of whom included the capsule in their advancement sutures.

Dr. Goldberg was quite right in calling attention to the fact that strangulation and sloughing of the muscle with slipping of the suture were troublesome features that impaired success. His own operation avoided these by utilizing (1) whipstitch fixation, (2) capsular loop and (3) scleral anchorage. He believed that the crumpling which resulted was better than tucking or folding.

Dr. H. Maxwell Langdon said that the Prince operation was so simple and satisfactory that he thought it should not be neglected. Two sutures are required one is placed tangent to the cornea, about 1 mm. from the limbus, for a space about 2 or 3 mm. through the sclera, the end of the suture being uncut. The conjunctiva and Ténon's capsule are opened and Prince's forceps adjusted to the muscle, which is separated from its scleral insertion. The needle of a single-armed suture is passed from within out through the muscle, capsule and conjunctiva. One end of this suture is then laid across the anchor suture in the sclera and the ends of this suture tied over it as tightly as possible. The muscle and conjunctiva are then grasped with forceps and pulled forward toward the anchor suture; the musculoconjunctival stitch is then tied,

the extra parts of the muscle being resected. Should there be an under result the stitch may be shortened, and should the result be too great the muscle may be allowed to retract before the knot is tied. There seems to be but little change in the after-effects of the operation, as no matter how tight the anchor stitch is tied the pull on it will contract its intrascleral portion somewhat and turn it into a loop with a smaller intrascleral part, allowing about ½ to 1 mm. of lengthening for the musculoconjunctival stitch. The anchor stitch must be tied tightly. The reaction is moderate. The stitches may be removed the fourth or fifth day, and the result is usually satisfactory.

Report of a Case of Pulsating Exophthalmos

Dr. G. Oram Ring exhibited a woman with a recurrence of pulsating exophthalmos five years after ligation of the carotid. At the age of two years a deeply seated cyst, at the upper and inner angle of the left orbit, with enlargement of the caruncle, was operated upon by Dr. William F. Norris at the University Hospital.

Following this operation a secondary enlargement necessitated another operation and then there developed a gradual proptosis downward, forward and outward, with a distention of the orbital and lid tissues. Dr. Ring examined the patient at the Episcopal Hospital while she was suffering from a severe attack of influenza. She stated she had had no ocular examinations during a period of thirty-three years. He found an extensive pulsating exophthalmos of the left eye and orbit associated with a painful exposure keratitis. A quiescent period of several years had preceded the shock of her father's sudden death, which occurred, under very tragic circumstances, just before her admission to the hospital. Following this shock the exophthalmos became so pronounced that complete closure of the lid was impossible. The proptosis carried the corneal pole 17 mm. farther forward than the fellow-eye and 10 mm. below it. There was a marked fulness of the

veins of the outer portion of the eyeball. The pupil was dilated. After a few weeks, in association with a definite betterment of her systemic condition, the cornea regenerated. She was then seen by Dr. Thomas R. Neilson, who performed a successful ligation of the left common carotid artery.

The operation was followed by definite recession of the globe and by a very considerable lessening of the vessel distention of the orbital tissues, especially above. The upper lid sulcus at the outer half was partially restored. Upon pressure the vessels seemed much softer in consistency and the congeries of orbital veins could be much more easily appreciated. The difficulty in lid closure rather promptly disappeared, as did some numbness in the left side of her face. In addition to the local treatment to the eye the patient was given six injections, at intervals of three days each, in the lumbar region, of 10 cc of 2 per cent gelatin. Another period of comparative quiet then ensued and the patient was not seen again for nearly five years. She then returned with exophthalmos somewhat increased from the last record. Further notes of her history show she had suffered the dual shock of the departure overseas of her husband and a severe miscarriage. A third shock still further augmented her oculoörbital symptoms: Her husband, gassed and shell-shocked, returned to America an entirely changed personality, indifferent to marriage ties, callous in moral obligations, a wastrel of money and, in short, with a distorted and unnatural perspective of life and its obligations. Hence the picture which she now presents. Her willingness to submit to any further operative interference brings to mind the ligation of the superior ophthalmic or other orbital veins. Enucleation of the eyeball, with the application of electrical desiccation to the orbital contents, has been considered, but up to the present the outcome has been regarded as too problematical to justify the risks.

Dr. Stevens reports the heart normal; the systolic pressure 150 and the diastolic 100. A faint systolic bruit is audible slightly above and to the right of the affected eye.

Impressions from Eye Examinations in Real or Supposed Neurotics or Psychoneurotics

Dr. Hiram Woods, of Baltimore (by invitation), in a paper on the above subject, said the clinical cases of the types referred to have grown more frequent in recent years, due in part to conditions induced by the War. Such conditions are mental, moral, economic and industrial. Symptoms are nearly all subjective, and it is difficult to determine what is real and what is not. The eye conditions admit of difference of interpretation. Patients easily grow dissatisfied and suspicious, attribute serious meaning to innocent criticisms and frequently accuse the oculist of having ruined his or her eyes. The cases detailed came from three sources:

1. Those who came directly because of supposed eyestrain.
2. House patients from the Sheppard and Enoch Pratt Hospital for mental diseases.
3. Those referred by physicians who were making an exhaustive search for a cause of a nerve disorder or nerve tire apparently functional, whether eye symptoms were present or not.

Class 1 complains of pain usually in and behind the eyeballs, and wished to know if pain, anergia, uncertainty, inability to sustain eywork and loss of power of concentration were due to the need of glasses. Clonic lid spasm and real blepharospasm were less frequent. Ciliary asthenia and actual visual defects were rare. Such patients frequently inquire if "nervous dyspepsia" and other remote conditions indicated an eye defect. Emphasis was placed upon the importance of the ophthalmologist's role as eye examiner, the case to be referred for systemic study to the physician.

The hospital cases were examined with a view to aiding the alienist in diagnosis and treatment. In this type hysteria, hallucinations and obsessions abounded.

In the third class the entire eye condition was asked, refraction and perimetry being emphasized. Emphasis was placed upon the importance of not asking such patients to detail their own

symptoms, the oculist's report to the physician being the essential requirement. This class has usually been diagnosed as neurotics or psychoneurotics.

From a considerable experience with the eye symptoms of these two conditions it seemed that a careful distinction between them is of more than academic importance to the ophthalmologist. In both we are dealing with a group of discomforts or abnormal functionings; but they exist in the one class—neurotic—in persons without impaired mentality. The extent to which the mind enters into a true neurosis is limited to maladjustment; the person cannot adjust himself to conditions at the time or overcome them. The cause is overwhelming, and it must be evident that if it is not removed the mental maladjustment may become permanent; but if the cause is removed he gets well and his neurosis disappears. In the psychoneurotic, on the other hand, there are from the beginning to the end defective mental powers. Any successful treatment must include not only search for cause but adaptation of treatment to the mental state. A neurosis due to some temporary cause might attack a previously healthy person or a psychoneurotic, but the management of the two cases would have to differ.

Can ophthalmologic symptoms help in differential diagnosis of these two conditions? Dr. Woods thought they can. The eye history before and after the appearance of the neurosis, the previous life and how now hampered, work and happenings about the time of appearance, are often helpful; in other words, how the eye trouble came on and then its nature. Pain, lack of concentration, inability to keep up eyework are symptoms usually accompanying certain eye findings which are more or less curable. With the psychoneurotic there are added mental uncertainty and lack of self-reliance. They are brought out, often, in routine examination of visual acuity and field vision. Such a person leans on somebody else. In reading test-types, for instance, he goes along swimmingly to, say, one-half normal acuity, then he comes to a dead standstill; he can read no farther. Let him shut his eyes for a moment, and when he opens them if someone is

at the typeboard pointing with a pencil to the normal line for twenty feet often he will read correctly. By previous examination with the ophthalmoscope we know he ought to do so, and with a little help he does. The same uncertainty is shown in field tests. The point of retinal exhaustion is soon reached. Apart from eye examination the patient's descriptions sometimes lead us to the truth.

Dr. Woods then spoke of some of the eye symptoms classified as evidences of nervous asthenopia, ocular neurosis, etc., and reviewed what was found in systematic study. (Undoubtedly the results eliminate some of the cases as neuroses, but, all the same, some of them had been so regarded and the rest were being studied with this diagnosis in view.)

First is pain. As stated before the pain was located in the eyeballs. Strictly *ocular* pains are not especially characteristic of ametropia, but they are suggestive of other things. One is ocular disease. In 3 cases sent to him for examination chronic glaucoma was found, with slight elevation of tension, in the thirties with the Schiotz tonometer, contracted fields and Bjerrum's scotomata. Central vision was normal and refraction error had been, in 2 of them, properly corrected. The fields had not been taken before nor had tension been measured. If the bending of the vessels in 2 of the cases—and in the third it was not very noticeable—had been seen at all it was not regarded as pathologic. Infected teeth, oral pyorrhea and sinusitis were uncovered in some other cases.

Dr. Woods discussed with some minuteness the muscular conditions. In the first place tension ocular pains are generally characteristic of muscular imbalance. Yet with the phorometer or Maddox rod results were often negative or nearly so. Not feeling that myasthenia had been conclusively eliminated there was used in doubtful cases Duane's shutter or parallax test, the possibility of developing diplopia by a colored glass and the duction power, in prism degrees, of individual muscles. As is well known the eyes can exert considerable control in the balance test, but in the short and quick exclusion of the shutter test with redress

and apparent movement of the object looked at when the screen is shifted it is a safe conclusion that the eye has deviated while under cover. The same is true of diplopia with a red glass. A brief period of wearing a prism with the base toward the suspected muscle will confirm or remove the suspicion.

As to the power of muscles to overcome prisms, with bases away from them, there is a difference of opinion as to whether or not it is worth anything. The prism power of the muscles which receive the most attention, generally speaking the internal recti, give the least valuable information. Power to retain single vision at six meters, with prism bases out and distance unchanged, is not a test of muscular strength. It is nothing but the patient's power to separate his convergence from accommodation to make one act while the other is idle. It is what Landolt called "positive relative convergence," just as there is a positive relative accommodation measured by the ability of the ciliary muscle to overcome concave lenses over their distant correction. True, both of these functions are of some importance. Abduction and adduction show a close and constant relation in normal eyes. Dr. Risley used to say that the proportion between the interni and externi should be, at the minimum, 3 to 1, but that 4 to 1 is better. However, exercise of one kind or another can greatly increase a defective adduction in a very short time. This means increased power of action without accommodation, not really increasing strength. On the other hand the externi, with their independent nerve supply, can be quite accurately tested. Noyes used to teach that 5 degrees of abduction was a minimum for normal strength and that over 8 degrees was too much. To a somewhat less extent the vertical muscles can be so measured. A supra- or infraduction of 2+ or 3 degrees is regarded as normal. These figures either have value or they have not. If of no value, and if the balance test is sufficient, the application of them to the subject under discussion is worthless; but in a large number of these patients with definite neurotic eye pains a general myasthenia, as measured by these duction tests, was found. An opinion regarding the relation of the horizontal muscles to each

other should be based more on the prism reaction of the externi than of the interni, and this because the latter act normally in convergence only with accommodation. It is at the near point where we get our best information about the interni. If an essential asthenia of the extrinsic muscles is a fairly constant finding in these neurotics their pain and lack of endurance can be understood. Because of their weakness the muscles soon reach the limit of endurance. Two conclusions seem justifiable: (1) This weakness makes the eyes ready victims to any irritation, and (2) this once started the eyes themselves become a new source of more irritation.

Only a small number of patients presented symptoms referable to the ciliary muscles, save when uncorrected or improperly corrected refraction was presented. Sometimes the near point is abnormally close and marked benefit follows removing such glasses, and thus lengthening out the near point and relieving the interni of an added task.

In examination of the fields in these cases it is absolutely necessary to avoid going beyond the exhaustion line and being sure that the patient knows what is wanted. When this has been done there is less variation and practically no interlacing of colors. But in a certain number of patients with neurasthenic symptoms, even when the fields are taken under advantageous conditions, there is a slight but definite and persistent concentric contraction. It rarely is over 10 to 15 degrees. Sometimes it is a little more in one field than in another. Has it any significance, especially as regards susceptibility to irritation? In other words, have eyes with this sort of field contraction a tendency to give out sooner under pressure than eyes with normal fields? There is nothing in the appearance of the disk to suggest atrophy, but may there be, with demonstrated loss of peripheral function, a falling of conduction in more centrally located fibers? The observation suggests the need for careful search for other nerve symptoms, toxemia, etc.

As a rule the pupils were equal in size and presented normal reaction to light and convergence. There were a few cases of

inequality and paradoxic reaction. An interesting observation was the occasional failure of cocain to dilate one or both pupils.

Regarding the lid phenomena in patients classed as neurotics or psychoneurotics there was frequent occurrence of Gifford's and Rosenbach's signs of hyperthyroidism. The first, difficulty in everting the lids, and the second, a pronounced and persistent trembling of the upper lids when they were closed gently. At the same time there was no suspicion of Graefe's or Dalrymple's signs.

Regarding treatment there is not much the ophthalmologist can do; refraction correction should be made, of course. As to the myasthenia, if one muscle is strong, out of proportion to its antagonist, a prism, base toward the weak muscle, may help; but in such cases the balance test usually gives a clue. If the internist, neurologist or alienist knows when to advise an eye review the best thing the ophthalmologist can do is to make his diagnosis, advise or give any treatment the eye conditions need; do it quickly and unostentatiously and then be seen as seldom as possible. His presence centers attention on the eyes, and that is just what should be avoided.

It is a question whether benefit is to be derived from periodic health examinations once or twice a year. So long as one s living up to industrial, domestic or social obligations, and feels well, he or she probably is well. We should bear in mind that it is usually the slight ailments and not the really serious things which produce neuroses. The cultured woman who has a recurrent breast carcinoma; the conscientious man with chronic nephritis for whom there can be only one end; the breadwinner, suddenly plunged into darkness by an explosion; all these may suffer from the first agonizing realization, but they do not become neurotic. It is the man or woman with some little thing physically, some emotional or industrial irritant, who fall victims. There is nothing like steady work to build up resistance and no surer way of destroying growth than everlastingly inspecting roots.

Dr. H. F. Hansell said the study of neuroses and psychoneuroses

in relation to their having ocular symptoms is interesting. It reminds one of hysteria and the ocular symptoms induced by that affection. Yet, as Dr. Woods announces, the distinction between the forms of neuroses is important in the diagnosis and treatment of these difficult patients. In the former the patient's mind is concentrated on the eye and in the latter the ocular attention given by the patient is the result of a psychic disturbance. He related briefly a case of each kind as illustrating his understanding of this distinction: A woman consulted him concerning her eyes. He found nothing wrong except an uncorrected error of refraction and uncorrected presbyopia, for which he prescribed correcting glasses. She returned from the optician in an antagonistic frame of mind and stated emphatically, and with the conviction of truth, that had she chosen the most ill-fitting pair of glasses in the shop she could not have selected any that were worse than those ordered. By a rare exercise of diplomacy she withdrew from the office without physical aid. She returned six months later wearing the glasses with comfort. The cordial relation of physician and patient continued for years afterward.

A young man had been shell-shocked in France. He was received months afterward in the Jefferson Hospital and claimed to be entirely blind. No lesion of any kind could be detected in the eyes or the body and his pupils contracted to light. The upset of his nervous system, induced by his experience in France, was intensified by domestic difficulties and total destitution. Under treatment and encouragement he regained full acuity of vision. The eyes here responded both to the imbalance and incoördination of the brain functions and to their restoration to normal.

That these phases of mentality do not come only to the uneducated and untrained minds, but to those of experience and intelligence, is illustrated by another case: An engineer, a man of culture and experience, was led to believe by a faking optician that he could not see to read through the near glass for the right eye, and he demonstrated the truth of his statement to the patient, thus inducing him to buy a $21 pair reduced to $3.50. The following morning he could see perfectly well with his old glasses, because the vaseline, secretly applied to the right glass, had been removed.

There is, to be sure, a psychic element, almost indeed a state of hypnosis. The community would invariably rather give credit to the charlatan than to the educated physician. It likes to consider itself advanced and progressive.

The muscular problems described by Dr. Woods are complicated and difficult to handle. For lack of understanding we try to explain them by referring their causes to a susceptible or hypersensitive nervous system. They are to be found in the same category of cases as those in which a quarter of a diopter of astigmatism causes asthenopia, and its correction temporarily gives relief. After a time the glasses are laid aside and to them is attributed the cure. In a sense this is true, but only partly, for an individual in good health, free from obsessions and imaginations, needs no such correction. The eye and the environment are not free from responsibility in the etiology.

He said that in these so-called functional nervous affections the collaboration of the neurologist and the ophthalmologist must obtain to the betterment of neurotic patients.

Dr. Albert C. Buckley said that he was in accord with Dr. Woods's statement, "Neuroses so frequently show themselves in eye function because the use of the eyes is so intimately connected with everything in life," and believed, without overemphasizing the matter, Dr. Woods might have added, "Because the eye is anatomically and functionally a part of the central nervous system, and therefore more intimately connected with the organ of adjustment of the organism as a whole, so that the ocular mechanism is chiefly concerned in the more important habits of the life of the individual, a receptor of the highest degree of importance from the standpoint of adjustment."

From his experience he believed a great deal of what would seem to be due to eyestrain—anergia, ocular discomfort, sense of fatigue, visual defect, etc., in profound neurasthenic and psychothenic states—are symptoms or evidences of diminished attentive power and increased susceptibility to fatigue.

Admitting that there are three distinct types of eyestrain—(1) that due to muscle disorder, (2) nervous innervation and (3)

psychic—frequently it is necessary to decide for the patient who is in the convalescent phase of a psychoneurosis, and who complains of eye symptoms, whether he should be sent to the oculist for a new refraction, particularly in patients who have recently been measured. The inclination is to have the refraction made for comparison with prior tests, but there is some doubt as to whether the patient should wear a change of lenses until he had passed well into an unquestionable convalescence, particularly if there were marked differences in the results of the examination of refraction periods. Puzzling experiences have been with patients who during the height of their disorder have discarded glasses which they had previously worn comfortably, declaring that they could see better without their usual correction. This has been observed especially in patients suffering from mild maniac attacks with mental exaltation.

The first group of patients mentioned are found among the depressive types of psychoses. In the neuroses, in many instances, ocular fatigue and other symptoms are the result of attempts to overcome eye defects.

Dr. William Zentmayer stated that the point which Dr. Woods makes in regard to color reversals and interlacing is a useful one. He believed it to be due to lack of concentration and comprehension on the part of the patient. It usually will not be present when the field is taken a second time.

Regarding the part played by the ciliary muscles in these neuroses it is important to bear in mind that an unequal accommodative power in the two eyes is not at all rare and occasionally requires consideration in the prescribing.

The failure of cocain to dilate the pupils in some of Dr. Woods's patients is probably linked up with the other two symptoms mentioned by him—Gifford's and Rosenbach's—as an evidence of perverted function of the thyroid. This has been before noted.

FEBRUARY 16

A Case of Convergent Strabismus with Absence of the Right Externus: Corrected by Tendon Transplantation

Dr. William Campbell Posey exhibited a boy, aged twelve years, in whom the right eye had deviated markedly inward since birth. The rotation of the eyes was normal, with the exception of outward motion in the right eye, which was absent. O. D., V = 20/70, O. S., V. = 20/20. Double advancement by the twin single-stitch method of the rectus internus was determined upon, but no trace of the right externus being found, tendon transplantation was performed, the outer halves of the exposed superior and inferior rectus muscles being united with the external portion of Ténon's capsule, which was advanced as far forward as possible. The left externus was advanced and the internus of the same eye was tenotomized. The results were surprisingly good, external rotary movement in the right eye becoming almost normal in extent and the visual axes parallel.

To what should be attributed this establishment of external rotation in the right eye? To the advancement of Ténon's capsule alone, or should we presume that the innervation of this tissue from some of the transplanted fibers of the superior and inferior rectus had an effect? It is difficult to conceive how partial tendon transplantations may be of value when the muscle which is to receive the innervation is found to be absent, yet this is the second case which he has shown to the Section in which rotation of the eye in the zone of action of the absent muscle has been made almost normal. The refraction under atropin is as follows:

O. D.; C. + 3.50 D.; axis 120° = 20/50.

O. S., S. + 1.75 D. ⌒ C. + 0.75 D.; axis 90° = 20/20.

Dr. H. F. Hansell said that in Dr. Posey's rare case of congenital absence of the external rectus muscle the question of binocular single vision should be considered. The operation is a brilliant

success and the power of external rotation of the eye given by the transplanted muscle is of value. It would be of interest to know whether diplopia is present and the relation of the images to each. The fusion center located somewhere in the cortex is either absent or undeveloped. Without it binocular single vision is unobtainable and the patient is beyond the age where Worth's methods might be available.

In answer to Dr. Hansell, Dr. Posey stated that he doubted if binocular single vision could be obtained in this case, on account of the lowered degree of vision present, resulting from the high astigmatism and from the partial amblyopia from disuse.

Extensive Involvement of the Ocular Muscles Due to Focal Infection of the Teeth

Dr. L. Waller Deichler (by invitation) read a paper in which he described in detail the case histories and symptoms of two patients presenting muscular involvement and one patient showing fundus changes as a result of focal infection.

Case I.—Male, aged sixty-five years, suffering from vertigo. The case was diagnosed as palsy of the left superior rectus and right superior oblique with paresis of the right superior rectus, left internal rectus, right and left inferior obliques, left superior oblique and moderate impairment in the action of the right internal rectus and both external recti. Roentgen ray showed absorption of the alveolar processes about the roots of the remaining teeth with pyorrhea and pockets containing pus.

Case II.—Female, aged twenty years, complaining of vertigo, occipital headaches, eye fatigue when reading and tilting of the head toward the right shoulder. Observation disclosed a progressive exophoria and a constant right hyperphoria. A discharge of pus through the gum from a dental abscess was followed by prompt relief of the ocular symptoms.

Case III.—Male, aged thirty-six years, complaining of visual impairment. Vitreous opacities obscured a view of the right fundus. In the left fundus, blurring of the disk, edema and a granular appearance of the retina was noted. Dental roentgen ray showed: Pyorrhea, apical abscesses, pericementitis and a large abscess with necrotic bone about the roots of the left lower first and second molars.

A Simplified Operation for Pterygium

Dr. S. Lewis Ziegler stated that in operating for pterygium he had always been impressed with the fact that the growth was composed chiefly of hypertrophied subconjunctival tissue, more or less cicatricial in character, and with a tendency to contract. He had for many years performed a simple operation, based on this suggestion, which had been a success cosmetically, and so far as he knew free from recurrence.

After severing the head with a Beer's knife and the neck with conjunctival scissors the forceps are handed to an assistant who holds the flap taut while the subconjunctival tissue beneath the flap is grasped by a second pair of forceps and carefully dissected off from the conjunctiva with the small scissors. The apex is then excised and the conjunctival wound closed by two sutures, which may cause overlapping of the corneal margin by the conjunctiva. This is usually clipped in several places by scissors and pushed back until the surface is smooth. Where a larger surface is bared two sets of liberating incisions are made above and below and the wound closed with three sutures. This technic of thinning of the tissues by subconjunctival excision can also be applied to other pterygium operations with considerable advantage because it makes a thinner flap.

Exudative Retinochoroiditis with an Unusual Corneal Condition

Dr. William Zentmayer exhibited J. B., aged twenty-five years, presenting in O. D. an area of retinochoroidal exudation about

four disk diameters by one disk diameter in size, below the macular with a slight descemetitis and increased tension. The Wassermann and von Pirquet were both negative. There were several dental apical abscesses, enlarged tonsils and hypertrophied turbinates. Urinalysis showed a slight trace of albumin but no casts.

Fields contained an absolute scotoma, corresponding to the fundus lesion. The tonsils were removed. Ten days later the left eye exhibited a group of pin-point to pin-head size subepithelial deposits grayish in color and occupying an area horizontally oval in the center of the cornea. A few days later the right eye showed the same condition. The dots persisted about two weeks. Subsequently there were recurrences in both eyes. At no time did they stain with fluorescein nor did the epithelium appear to be exfoliated. They resembled somewhat superficial punctate keratitis.

Examination with the corneal slit lamp microscope, made by Dr. Arthur J. Bedell, of Albany, revealed that these opacities were situated some in the anterior part of Bowman's membrane and some in the posterior layers of the substantia propria, and in the right eye, possibly on Descemet's membrane.

The supposedly affected teeth were extracted and showed only periapical disease. The nature of the corneal condition is not clear. It is a transient relapsing one. The only etiologic factor traced in the case is a focal infection. This may have had its origin either in the tonsils or teeth and the presence of albumin in the urine seemed to indicate that the toxin had affected not only the eyes but also the kidneys.

Whether this clinical observation is of any value in determining the etiology of this condition, it at least would seem to indicate the toxic origin of these opacities in this case.

It may be recalled that Verhoeff attributes these infiltrates to the action of pyogenic diffuse toxic substances acting on the nerve terminals.

The Hess Operation

Dr. T. B. Holloway presented 2 cases showing the results of a Hess operation for ptosis. At the time these cases were placed on the program it was his intention to present them owing to complications that had arisen following operation.

Case I.—A boy with slight epicanthus and unilateral ptosis of the left eye. The palpebral fissure on the affected side measured 4 mm. There was marked impairment in the upward rotation of the globe. Following the operation an abscess developed in the upper lid. It was feared for a time that the result would be a poor one, but, contrary to expectations, it has been excellent.

Case II.—A male adult with unilateral ptosis of the left eye and defective upward rotation. The width of the palpebral fissure was 3 mm. A hematoma followed the insertion of the innermost suture. Subsequently the lid became red and puffy and considerable sanguineous pus was evacuated through the outer end of the eyebrow incision. Despite this complication the result has been excellent and the palpebral fissure of the same width as in the other eye.

Dr. William Campbell Posey said that about a year ago Dr. Heed exhibited a case before the Section showing excellent results obtained by the Hess method in correcting ptosis. As Dr. Posey had performed this operation a number of times, also with satisfying results, and in fact was just discharging a case from the hospital in which the operation had been most successful, he gave his testimony as to the value of the procedure. But a few weeks later, however, he had an experience which caused no end of anxiety and had led him to modify his views somewhat regarding the procedure, for in attempting to raise the lid of a lady, aged forty-six years, which had drooped since the patient was nine years old, following an attack of scarlet fever, vision, and indeed the eyeball itself, was nearly lost in consequence of a keratomalacia or rather

of an intense uveitis with some orbital involvement following the exposure of the eye after the protective covering of the lid had been removed. The operation was performed as usual: The sutures were tied and the usual sterile vaseline dressing was applied. Twenty-four hours after the operation, however, the patient complaining of some pain and a sticky sensation in the eye, the dressing was removed and the cornea found to be slightly hazy in the pupillary center. All dressings were at once removed except a slight protective one at night. The cornea was kept moistened with liquid vaseline, atropin was instilled and the eye flushed gently three or four times a day with a boracic acid solution. Twenty-four hours later, in spite of this, the corneal haze had spread toward the periphery, and in another twenty-four hours the entire epithelial and subepithelial layers of the cornea were hazy. There was also some chemosis of the bulbar conjunctiva. Realizing the danger of the situation the stitches raising the lid were removed and the lid permitted to drop down over the cornea. Despite this, however, there was no betterment in the symptoms—indeed, both the corneal haze and chemosis of the bulbar conjunctiva increased and there was some swelling of the lids. The site of the sutures, however, showed no infection, nor was there any discharge from the conjunctiva, the ocular condition being allied to a keratitis-neuroparalytica, with uveitis and mild orbital involvement. This diagnosis was concurred in by Drs. de Schweinitz and Fox, who saw the case in consultation and who greatly aided in their therapeutic suggestions. In addition to the local measures just outlined constant applications of ice were ordered and 10,000 units of diphtheria serum injected hypodermically. After a few days of constant oversight the local conditions gradually improved, so that the patient was discharged at the end of a month, with the eye fairly quiescent but with a central haze of the cornea. Seen at the expiration of five months, the patient living at a considerable distance, the corneal haze was less. Vision, however, equaled but 5/60; prior to operation it had been 5/15, this reduction being due to a slight amount of nearsighted astigmatism. Massage of the globe with yellow oxide salve and the use of hot compresses is

still persisted in, in the hope of still further clearing the vision. The position of the lid is much the same as it was before the operation. Perhaps on account of the cicatricial bands originated by the sutures there is now some slight elevating power.

Dr. William Zentmayer stated that Hess advised during the period of lagophthalmos following this operation that the eye should be protected by a watch-glass, after the manner of the Buller shield, as illustrated in Meller's book.

Dr. S. Lewis Ziegler suggested that in cases of corneal exposure after the Hess operation the cornea might be protected by adjusting a small celluloid shell as a protector to fit directly over the cornea, like the ones he used in cases of corneal tattooing.

Dr. Holloway stated that, following this operation, he always resorted to a dressing made up of a ring mask in which the prominent part corresponding to the eyes had been cut away, and on the side corresponding to the operation the opening was covered with transparent celluloid. These were the first instances in which he had any complications following this operative procedure, and it had been his original intention to present them as complicated cases; but he felt that the final result was just as good as in those cases in which no complication had occurred.

In each patient there was an exaggerated Graefe sign on the affected side, and in each instance the palpebral fissure became distinctly wider when the eyes were rotated strongly to the left, *i. e.*, toward the operated side.

It was also stated that a thorough and complete dissection, almost to the margin of the lid, was important; this applied particularly to the lateral extremities.

Owing to the fact that the lid sutures almost invariably cut through, Dr. Holloway believed the use of small plates, metal or rubber, would be of service.

Searchlight Reflex of the Macular Region

Dr. P. N. K. Schwenk showed a case of searchlight reflex at the macula in a boy, aged eleven years. His right eye is nearly emmetropic and the left has a myopia of 8 diopters.

The left eye has a small central white depression at the macula which gives off a cone of light like a searchlight. Frost, in his book on *Fundus Oculi*, says, "This phenomena was first described by Marcus Gunn, who says it usually is associated with myopia, and called it the policeman's lantern reflex."

The searchlight reflex seems to Dr. Schwenk to be a better analogy, as the searchlight may not have been known in Mr. Gunn's day.

MARCH 16

Unusual Type of Cataract

Dr. Warren S. Reese (by invitation) exhibited a male patient, aged twenty-nine years, with bilateral cataract. The lens presents a 5 mm. circular opacity, occupying the pupillary area, and in the anterior cortex, through which a fair fundus glare is obtainable. In the center of this opacity are numerous other perfectly opaque, nodular opacities. These extend almost to the periphery of the large circular opacity.

Dr. William Zentmayer said the type of cataract shown by Dr. Reese is probably that pictured by Bach and also by Collins, and described by the former as a case of lamella and central cataract. The arrangement of the denser opacities in the center of the nucleus resembled somewhat that of coralliform cataract, but they have a waxy rather than a crystalline appearance. It is probable that these opacities within the zonular region are due to accumulation of granular matter in the lines of separation between the different layers of the lens—the so-called "lens star."

Dr. Burton Chance said that he was greatly interested in Dr. Reese's case by reason of the fact that he discovered that the young man had been under his own observation a number of years ago. Indeed, he was one of five in a family presenting in each eye the same form of cataract. These disciform cataracts are known in

literature as the "Coppock," from the name of a family among which Nettleship and Ogilvie found seven generations so affected. Dr. Chance's cases were reported at the meeting of the Ophthalmological Society in 1907. None of the family has been seen by Dr. Chance since then, but he immediately recognized the man's eyes. He would only add that, so far as he is able to recall to his memory the unusually accurate drawings by Miss Washington, the cataracts have not changed in size nor density nor the eyes in their refraction. It is of additional interest to learn that the young man was accepted for military service in 1918.

Localized Cataract with Unusual Fundus Changes

Dr. Warren S. Reese (by invitation) exhibited a male, aged twenty-eight years. Three years ago he was struck in the left eye with a hand grenade fragment. He now presents no external evidence of injury. Through the dilated pupil a localized opacity of the lens can be seen in the extreme nasal periphery. From this point a rather wide silvery band runs backward through the vitreous and, as it reaches the posterior pole, expands into an area of choroiditis just up and in from the disk. In the lower nasal periphery there is a localized detachment of the retina. Notwithstanding the above changes the patient's vision is improved to 15/20 with a—2.50 Sph.⌒ + 6.00 cyl. axis 90. A small foreign body has been localized by the roentgen ray, 6 mm. back of the center of the cornea in the horizontal plane and 8.5 mm. to the nasal side.

A New Protractor Card

Dr. Sidney L. Olsho (by invitation) showed a new protractor card for verifying the axes of cylindrical and spherocylindrical lenses.

The card is printed white on a black surface. The two central concentric circles are used as a guide in placing the lens to be

examined face downward in the center of the figure on the card. The two diamond dots or other points marking the 180 degree or horizontal meridian of the lens, must fall on the 180 degree line of the figure. The lens is then carefully marked with the sharp, white, china-marking pencil by two short marks on the posterior surface of the lens, near the periphery, each short mark directly opposite the axis degree *as it was prescribed.* A spherocylindrical lens should be pencil-marked also on the meridian at right angles to the prescribed axis, so that one may verify that the optical and geometrical centers coincide.

The lens is then held a short distance from the card and one of the heavy straight white lines on the card is viewed through the lens. There should be no displacement of that section of the white line on the card seen through the lens from those sections of the same line viewed above and below and not through the lens. If the cylinder axis is as prescribed, and if the lens is not "off" center, the line so viewed will be continuous when passing through either pair of our short white pencil marks on the lens. An "off" centered lens introduces a prismatic effect which may be highly undesirable.

When neutralizing the cylindrical test lens must be held just parallel to the short white marks which we have placed on the prescribed axis of the lens to be tested and the lens should neutralize at the marked axis.

With the aid of the protractor card the geometric center of lenses is easily determined, and it is the author's custom to cross-line both lenses completely, vertically and horizontally, through the geometric center with the white pencil and to note the position of these lines when examining the glasses as to their adjustment. The horizontal lines must always be segments of a continuous line. Their height must be on a level with and bisect both external canthi.

A New Trial Frame

Dr. Sidney L. Olsho (by invitation) showed the mechanically perfected model of his trial frame and described the method by

which refraction is coördinated with spectacle and eye-glass fitting, a method by which trial lenses are held in a definite position as to height, tilt and axis, with which position the finished spectacle or eye-glass lenses are made absolutely to coincide.

The essential features of the trial frame are:

1. The front is rigid.

2. A horizontal test rod rests on four supporting pins and crosses the four marks indicating the 180-degree meridian of the trial frame. It is used to verify the alignment of the trial frame front.

3. Two centrally beaded, short, horizontal rods replace the single rod when the trial frame is on the patient's face. The trial frame is so positioned that the two rods are each exactly opposite an external canthus.

4. The trial frame temples are straight. They are delicately, yet firmly, separately adjustable as to tilt and lateral pressure. Tilting both temples equally tilts the plane of the trial lenses. Tilting one temple separately raises the corresponding temporal end of the trial frame front.

5. The test lenses are thin and placed close together in the trial frame. The axes of the cylindrical lenses are distinctly marked on the lenses at *geometrically* opposite points. When any two-trial cylinders are placed in the trial frame at the 180-degree axes the four markings on the two-trial lenses become continuous with the four 180-degree marks of trial-frame axis scale, whereupon all these eight marks fall on one line.

Advancement and Transplantation for Paralysis of the Superior Rectus

Dr. Burton Chance presented a case of paralysis of the left superior rectus together with partial ptosis, believed to have been caused by infantile paralysis, in a girl now sixteen years of age. A resection advancement of the superior rectus was made and slips from the lateral muscles were united to the

advanced mass. The simple sutures advocated by Posey were employed. These have held securely, and marked upward movement has been obtained with no interference with the lateral rotations.

Coloboma of the Disk and the Retina

Dr. Burton Chance presented a case of triangular coloboma of the temporal half of the disk and of the adjacent uveal tissues in each eye of a middle-aged colored woman.

Artificial Tendons

Dr. Burton Chance exhibited a case of angioma of the orbit, reported three or four years ago, in which the elevators of the globe had been involved in the vascular mass and the young woman had never been able to rotate the eye upward. Moreover, there was absence of check muscles and capsular tissues. It was conceived that strips of skin from the forehead might be united to the globe to serve as "check ligaments" if not as artificial tendinous structures. Accordingly, narrow strips were dissected from the superciliary region, turned on their bases and drawn through tunnels through the orbicular into the retrotarsal fornix and united to the scleral tissues. These bands have held well for over a year, and, by being on the stretch, they tend to raise the lid and have distinctly elevated the anteroposterior axis of the globe, greatly improving the girl's appearance, as well as adding to her comfort, by reason of the backward pull which they exert.

Pneumococcic Ulcers

Dr. William Zentmayer exhibited a man who had been admitted to the Wills Eye Hospital about four weeks previously with an extensive pneumococcic ulcer. Under the use of Shahan's ther-

mophore and the use of ethylhydrocuprien the ulcer healed without perforation. At present the anterior chamber is of normal depth and there is a scar covering two-thirds of the central part of the cornea, grayish in color. The patient was exhibited as showing the result of what might be termed the modern treatment of pneumococcic ulcers and also to call attention to a possible danger in the use of ethylhydrocuprien.

He also referred to a woman, aged thirty-seven years, with dacryocystitis, who had had injected into the sac through the canaliculus several drops of a 1 per cent solution of ethylhydrocuprien besides having had the sac washed with mercurophen after the use of holocain, one hour later complained of excruciating pain and exhibited an exfoliation of the epithelium of the cornea, over a surface of 5 mm. in diameter. Fortunately there was no longer any discharge from the sac, as this had ceased after the second treatment. At first the thought was that the epithelium had been abraded either by the probe or as the result of the combination of chemicals used at one sitting. However, Dr. Ball, of St. Louis, in a personal communication, stated that he has seen this occur more than once after the use of ethylhydrocuprien, and Dr. Bedell, of Albany, has seen such a result following the use of the drug in rabbits; it is more than likely that the ethylhydrocuprien was responsible. The solution used had been prepared a week previously for the treatment of the same condition in another patient (also cured) and was therefore not entirely fresh.

Dr. Burton Chance said that as he had somewhat reluctantly adopted the use of hydrocuprien he had always been cautious in administering it. He had not seen such effects as those specified by Dr. Zentmayer and by Ball follow its use; indeed, in a recent case of lacrimal sac disease, quite like that detailed by Dr. Zentmayer, he had used it with the greatest freedom he had yet exercised, without untoward results. He is inclined to believe that the unexpected action upon the cornea arose because of chemical reactions produced by the mixture of the many other solutions employed. He further believes in the use of valuable drugs con-

taining specific active principles, that harmful or objectionable effects are produced by the chemical changes brought about by the simultaneous mixing of a multiplicity of collyria.

Angioid Streaks in the Retina

Dr. William Zentmayer exhibited a case of this condition in a patient whom he had first exhibited in 1909 and again in October, 1914. There are undoubted changes in the appearance of the streaks. They are much less conspicuous, indeed, some portions of them are scarcely visible. The macular region in the right eye is occupied by an oval, complete atrophic area, with some pigment at its lower border. In the left eye there are hemorrhages below the macula.

Vision when first seen was: Right eye, 6/9; left eye, 6/6. Today it is: Right eye, 5/15; left eye, 1/200.

When he came, in 1909, he had a dendritic ulcer of the cornea and he again exhibits the same condition.

Dr. Burton Chance said that the origin of the angioid streaks has continued somewhat a matter of speculation. To those who had the opportunity to examine many cases of military injury to the globe the bizarre proliferation of retinochoroidal pigment frequently seen must have been commented upon. He had himself seen but few cases of angioid streaks before the War, but during his army service the thought of the resemblance of war cases to these unusual ones had been in his mind, for had they not the same form of retinochoroidal traumatism accompanied by pigment proliferation? and might they not lead to similar formations as in the streaking depicted in Dr. Zentmayer's case? In each type there is the history of contusion or concussion, extravasation and development of connective tissue and profuse wandering of pigmentary elements.

A Case of Divergent Paralysis

Dr. L. W. Deichler (by invitation) said divergent paralysis is a rare condition. It is one of primary convergent excess and

characterized by convergent squint and homonymous diplopia, greatest in degree for distance, disappearing entirely with single binocular vision and orthophoria as the point of fixation approaches the face. Cases have been reported as secondary to abducens palsy, which condition they resemble, but true paralysis of the sixth nerve never produces a diplopia and squint which diminish or remain the same as the eyes are rotated to the right and left, nor are the excursions of both eyes of normal extent.

Clinical Notes of the Case Reported: Female, aged forty-eight years. Examined January 24, complaining of diplopia. Always enjoyed good health and had no previous eye symptoms. Vision, 20 30, each eye; pupils equal and react normally. There was alternating convergent squint with preference for the left eye. Ocular rotations full. Esotropia of 30 degrees at twenty feet; homonymous diplopia in all fields with the light held at 1 meter. Light held at 13 cm. produces single vision and disappearance of squint. Single vision is retained, both eyes fixed upon the object, as it is carried to the right or to the left in the horizontal plane for about 20 degrees to the right or left of the median line, when one eye remains fixed and the other promptly turns in with reappearance of the diplopia.

With the light at 1 meter from the face and in the median line both images are on the same level, but when it is carried to the right or to the left in the horizontal plane in abduction the images approach each other and are closest together in extreme abduction, remain upon the same level and are parallel throughout. At the same distance from the face the images remain on the same level and the same distance apart in all parts of the vertical field.

Duane states that true divergence paralysis develops suddenly and is often caused by organic brain disease. In this case there was a sudden development and there has been a progressive loss of health and strength with a peculiar ashen-gray tint to the skin.

Dr. William Zentmayer said he was surprised at the statement

made by Dr. Deichler that he had found but one other case in literature. Several cases have been reported by Duane and one case by himself at the College of Physicians of Philadelphia several years ago, and recently he had given the notes of a case seen in consultation with Dr. Langdon where this condition was a complication of encephalitis lethargica. He had seen two other cases, one in a physician and one in the son of a physician.

Melanosarcoma of the Choroid with Metastasis at a Trephined Area

Dr. George H. Cross reported the case of Mrs. H. D., aged sixty-five years, white, American, married. First seen October 20, 1921, complaining of recurrent attacks of sharp pain in the right eye.

Her father died of cancer of the nose, mouth and throat at the Jefferson Hospital. A brother died, at the age of thirty-five years of cancer of the head at the Jefferson Hospital. Another brother, operated ten years ago at Johns Hopkins Hospital, had his abdomen opened and then sewed up, nothing being removed. He is still living but unable to do heavy work.

History of Present Illness. July, 1920, after several attacks of pain in O. D., the patient consulted an oculist; under treatment the pain subsided but recurred at intervals. In February, 1921, a corneoscleral trephining was done, with no relief from the periodic attacks of pain. There was no vision in the painful eye; the tension was soft; the pupillary space was filled with a yellowish exudate over the lens and a slight elevation at the trephined area. She was advised to have the eye enucleated, which was performed October 28. Upon removal of the globe there was observed a spherical mass, about 8 mm. in diameter, around the nerve at its exit from the globe. The specimen was referred to Dr. Case at the laboratory of the graduate school of the University. Upon gross examination there was found a grayish tumor, through which numerous dark streaks were

observed, evidently a choroidal growth, on out section measuring about $3\frac{1}{2}$ x 9 mm., with a posterior extension outside the globe and a metastatic growth at the site of the trephine scar. The lens is drawn toward the site of the trephine scar.

As the tumor is of interest only on account of its metastasis to the trephine scar no attempt will be made to give a complete description of it. The microscopic examination of the specimen reveals it to be a melanosarcoma of the choroid extending forward along the choroid and backward along the optic nerve. The metastatic growth appears as a separate distinct mass at the site of the trephine scar, not connected with the forward extension of the tumor.

Dr. S. Lewis Ziegler stated that Dr. Cross's cases of sarcoma had many interesting features, but metastasis had occurred so early that radium applied in the socket would not have influenced the result.

He further wished to state that the interesting case of supra-orbital sarcoma which he had exhibited in January, as cured for more than two years, had recently been attacked with grippe, which was followed by hemiplegia, convulsions and death. He had not learned further details except that there was no sign of recurrence, and vision in O. S. had improved to 10/200.

Dr. William Zentmayer said that, of course, it is not always possible to diagnosticate intracocular growth in the presence of acute glaucoma. If the operation is done with the supposition that the glaucoma is primary the danger of local metastasis is increased by the operation. He recalled one case in which he found that orbital metastasis had resulted from a sclerotomy done under the supposition that the deached retina was a serous one, and which proved to be secondary to sarcoma.

Specimen from Coralliform Cataract

Dr. William Zentmayer exhibited a specimen showing crystals from a case of coralliform cataract, the clinical and operative history of which was reported previously.

The specimen had been prepared by Dr. Verhoeff, who states that from the fact that the crystals have the same morphology, stain the same way in eosin and carbol-fuchsin and give the same reaction for protein with Millon's reagent, prove them to be identical with those which he described in a case reported two years ago before the American Ophthalmological Society, and which he determined to be of protein nature.

APRIL 20

Col. R. H. Elliot, London, England (by invitation), read a paper on "Glaucoma Halos." Discussion by: Dr. J. Gray Clegg, Manchester, England; Prof. G. F. Rochat, Groningen, Holland; Dr. J. W. Nordenson, Stockholm, Sweden; Dr. J. O. McReynolds, Dallas, Texas.

Prof. E. Gallemaerts, Brussels, Belgium (by invitation), read a paper on "The Barraquer Operation." Discussion by: Col. R. H. Elliot, England; Prof. G. F. Rochat, Holland; Dr. J. W. Nordenson, Sweden; Dr. J. Gray Clegg, England.

Dr. J. O. McReynolds, Dallas, Texas (by invitation), described in detail the operation "Transplantation of Pterygium."

OCTOBER 19

Superficial Punctate Keratitis.

Dr. Wm. Zentmayer presented a man, aged forty-two years, a mail carrier, who came to the Wills Hospital because of a mist before his right eye, which had been present for twelve days, and was accompanied by a sensation of a foreign body in the eye. He gave a history of frequent colds previous to having had his

septum straightened one year ago. The eye affection gave the usual history of a preceding coryza and a slight conjunctivitis. The left eye was unaffected. The lesions were small and grouped in the central portion of the cornea, the overlying epithelium being slightly elevated. There was no anesthesia.

Extensive Pigmentation of Conjunctiva

Dr. Wm. Zentmayer presented a colored woman, aged about forty years, with an unusual pigmented condition of the conjunctiva in the right eye, starting at a point about four o'clock and encircling the cornea to about eight o'clock. The pigment was of a chocolate-brown color and was distributed much like a subconjunctival hemorrhage, there being a dense central area and a gradual fading off from this into the surrounding conjunctiva, the densest portion being somewhat elevated and granular, and at two points invading the cornea for a distance of about 2 mm. There was no disturbance of the function of the eye. The patient stated that this condition had been present from birth, but that within the past year it had increased in size and had become annoying. The case had been too recently seen for careful study, but appeared to be a nevus which is becoming malignant. It is the intention to have the corneal portion desiccated before advising a more radical operation.

Professor Barraquer's Operation in Philadelphia

Dr. Wm. Zentmayer reported on the results in the Barraquer operations performed in Philadelphia. He first described the instrument and the method of procedure, and concluded that the number of operations was too small from which to draw conclusions. The visual results are not equal to those obtained by an operator of far less experience and dexterity operating by the extracapsular method. The absence, in this series, of com-

plications so frequent in the expression method of the intracapsular operation is probably due more to the skill of the operator than to the safety of the method.

In the cases reported there was: Vitreous loss, none. Iris prolapse, none. Severe reaction resulting in occlusion of the pupil, one. Failure to deliver in capsule, three.

The vision was: 6/9, two cases. 6/12, one case. 6/15, two cases. 6/60, one case. Not recorded, one case. Probable hand movements, one case.

Granted that this procedure gives visual results superior to the extracapsular operation, it does not seem justifiable to assume the undoubted risks pertaining to this method when the lens is secured in its capsule in only 62.5 per cent of the cases.

Dr. Howard F. Hansell said that no doubt the Barraquer operation performed by a skilled operator, and under exceptionally good condition of patient, operator and environment, leaves nothing to be desired. Its advantages are obvious. All intracapsular extractions, where everything goes right, are presumably superior to those in which the capsule is left behind. Before attempting such procedure the operator must be thoroughly familiar with the difficulties and risks and must give them full consideration. The record of the results of Barraquer's personal performances at the various hospitals in Philadelphia, as reported by Dr. Zentmayer in his well-prepared paper, are not encouraging. Personally, I see no reason for the adoption and practice of the method, and I shall continue to operate in all cases in which I have the choice by the method I have advocated for years, namely, preliminary iridectomy, the use of the capsule forceps and expression. We should remember that the patient's welfare is our first consideration; that nothing else counts. After all, the retention of the capsule is not a serious matter. I do not agree with Dr. Knapp, who has expressed the opinion that discission is a serious operation. Naturally we would like to avoid capsulotomy, but if it should be necessary, it is comparatively free from danger when done under proper antiseptic measures.

Dr. P. N. K. Schwenk said he did not consider the Barraquer

operation as safe a procedure as the usual combined extraction. In his judgment too many eyes were sacrificed before one could become proficient in the technic. He felt indebted to Prof. Barraquer for demonstrating his modified Van Lint method of anesthesia, which he has since employed in all his cataract operations.

Dr. T. B. Holloway stated that he thought the work done by Prof. Barraquer while in this country was an exhibition of skill that one is seldom privileged to witness. As far as his own cases were concerned, there was not the slightest slip in routine or technic. As Dr. Zentmayer stated, 3 of his cases were operated upon, 1 of these being a mature, another a slightly hypermature and the other an immature cataract on which a preliminary iridectomy had been done. If these are to be compared with his 3 cases that had been operated upon by Col. Smith, the results were decidedly better.

All things being equal, and assuming an experienced operator, adequate sterilization, etc., probably the greatest danger in cataract extraction is unexpected orbicular action. The fact that certain operators prefer to control the lids by the fingers, others by a speculum removed at different stages, Col. Smith, by his ingenious hook (which Dr. Holloway felt should be on the instrument tray for every case in which the eye is opened), the excision of the external canthal ligament by Axenfeld, and finally the use of the Van Lint injection seem to substantiate this.

Prof. Barraquer was clever and wise enough to fortify his procedure by the use of the last method as well as by a conjunctival flap suture. As Dr. Hansell has intimated, this suture doubtless resulted because it was found expedient in the experimental stages of this operation, and it will be recalled that these early statistics are not available. Dr. Holloway thought that without the Van Lint injection the Barraquer procedure would be a dangerous one. This operation, and the Smith-Indian operation, are highly technical, and it was felt that they should not be attempted by anyone until he had mastered the older operative procedures and felt competent to deal with the complications that

might arise. Personally, he preferred, in a certain group of uncomplicated cases, to do a preliminary iridectomy, and he would desire such an operation to be done on himself in case an operation should be necessary. For the remaining uncomplicated cases a combined extraction was preferred. In all complicated cases a preliminary iridectomy was thought advisable, and among these complicated cases he would include those instances in which the fellow eye was bad, either as a result of disease or because of failure of a previous operative procedure. It was felt that in the last instance it was fair to assume that the operator was not at fault, but that the patient was what might be regarded as a bad actor.

Dr. S. Lewis Ziegler stated that his experience with intracapsular extraction was limited to three operations that he had seen Barraquer perform at Wills Hospital and some half-dozen that he had seen Smith perform, together with a series of Smith-Indian operations that he had performed himself some years ago. He had experienced no bad results, but there had occurred some curious clinical manifestations that he had never seen in the ordinary type of combined extraction, probably caused by the sharp pressure required in the use of the delivery hook. Future experiments may develop a simpler and more successful procedure, but one cannot enthuse over the present status of the intracapsular operation either as to technic or end-results. Removal of the lens in its capsule leaves a globe without a truss for internal support and without an interfering capsule. We no longer fear after-cataract, because it is so quickly relieved by V-shaped capsulotomy.

He cannot agree with those who favor preliminary iridectomy, except to relieve one condition, cataract complicated by uveitis or posterior synechiæ, which von Graefe demonstrated was favorably influenced by iridectomy. Immature cataracts are better delivered by free cystotomy combined with removal of the cortex by aspiration or by irrigation. Aside from the dangers of added traumatism arising from two operations, there is the depressing

psychological effect occasioned by disappointment and waiting on the part of an aged and infirm patient who gains no visual improvement from the extra operation. Some also prefer to add a preliminary cystotomy, but this delay is likewise disappointing to the patient.

Dr. Ziegler always prefers to make the combined operation at once, and so end all anxiety. If this is performed with the average skill, the result will be a success, and he can see no good reason for making "two bites of a cherry."

Dr. Wm. Campbell Posey said that the previous speakers voiced his views in the performance of the cataract operation. On account of the strain, both mental and physical, he limited preliminary iridectomy to only so-called "desperate" cases, *i. e.*, where the other eye had been lost for some reason. He thought Prof. Barraquer should be commended for the exceeding care which he gave to all the details of his operation.

In answer to Dr. Hansell's query, Dr. Posey replied that preliminary iridectomy, while in itself a simple procedure, necessitated in many instances the patient's going into the hospital three times for the preliminary iridectomy, for the extraction and for the needling. While an excellent procedure, it was not to be recommended in most cases, and only resorted to where there were extraordinary risks attending the operation, as, for example, when the fellow eye was hopelessly blind.

Dr. Burton Chance said it had been his privilege to receive Prof. Barraquer at the Wills Hospital, to attend him throughout his visit there and to witness all the operations performed by him. It was something worth while to see the Spaniard's use of instruments and to note the dexterity of his beautiful hands. His long knife, with the back edge made keen for a number of millimeters, was interesting, as was also the beak of the iris-forceps, which ended in a straight point at right angles to the curve of the jaws, thus providing a sort of shoulder which by supporting the corneal flap facilitated the seizure of the iris in the peripheral zone and thus helped to make the small buttonhole coloboma possible.

Dr. Chance marvelled at the poise of the surgeon in the midst of unfamiliar surroundings; many things happening to interfere, the uncertainty of the electric motor to drive the erisiphaque; the strange faces; the impediment of languages; everything, yet he rose serenely over all. The length of time occupied in the preparation of the patients and the duration of the operation, Dr. Chance's patient required forty minutes, were of particular note. In conclusion, he said he wished that he might have had an opportunity to see Prof. Barraquer operate by the ordinary flap and expression method. He is grateful to him for demonstrating the power of the injection of novocain, which so surely serves to control the lids that Dr. Chance has not had one escape of vitreous in the forty extractions he has had since he has employed it.

Dr. Zentmayer said, in closing, that the discussion had taken a scope beyond the limits of his paper, but had served the useful purpose of again putting the members of the Section on record as to their preferences in cataract operations. And he would add his, which is for a preliminary iridectomy where the patient is under fifty-five and the cataract immature. Otherwise, he prefers combined extraction. Where possible, he does a cystectomy.

Replying to Dr. Ring, he stated that he believed unfavorable visual results in the paper presented were due to the fact that the result had been reported very soon after the operation and that the refraction was probably somewhat hurriedly done. Some of the cases showed a haze in the anterior part of the vitreous, which accounts in part for the poor visual results.

In reply to the query why Prof. Barraquer stitched the lids together, Dr. Zentmayer stated that he had not seen this done, but knew that it had been done in some of the operations. He supposed it was done because there was a temporary paralysis which prevented complete closure of the lids, and also because it was an excellent procedure, aside from the further complication of an already elaborate technic.

Removal of the Cataractous Lens by a Suction Method

Dr. Frank C. Parker (by invitation) said the removal of the cataractous lens by means of the suction or, more correctly speaking, the vacuum method can be accomplished without a cumbersome apparatus, as advocated by Barraquer. The apparatus may be simply a tube, one end of which terminates in a properly designed cup for approximation to the anterior capsule of the lens, while the opposite end is connected to a mouth-piece through a small rubber tube. This comprised the apparatus with which twelve cases were operated upon. Buccal suction was found sufficient to remove the lens.

The lenses extracted, as shown in the illustrations appearing in Barraquer's paper in the *American Journal of Ophthalmology* for October, 1920, showing the lens being withdrawn, as is customary in a regular combined extraction, were prone to be followed by a small amount of vitreous, as no air could enter to fill the evacuated space formerly occupied by the lens. The secret of extraction by this vacuum method lies in tumbling the lens on a horizontal axis, so that during removal the suction or vacuum cup is beneath the lens, whose posterior surface now lies in contact with the cornea. By tumbling, air is admitted, and also the zonula is broken, allowing of easy extraction.

In Dr. Parker's twelve cases he proceeded as in the usual combined extraction, a small iridectomy being made. Van Lint's injection was used to control orbicular spasm.

He thought the danger associated with any suction or vacuum apparatus lies in its possibly becoming detached from the lens, allowing of evacuation of the contents of the globe through the tube. This danger he has eliminated by a recently constructed instrument which can be plunged directly into the vitreous with any amount of suction, buccal or instrumental, and sustained for any length of time without the loss of more than 1 or 2 minims of vitreous, fluid or otherwise. An absolute protection is guaranteed that no more than this small amount can be drawn up

into the tube. This removes the danger of this particular operation as far as accidental withdrawal of vitreous is concerned.

As to the adoption of this method, he did not wish to appear as an advocate of the promiscuous extraction of cataracts by this procedure, but simply desired to make it known that a complicated apparatus is unnecessary and that buccal suction can be utilized.

Dr. P. N. K. Schwenk said he considered that Dr. Parker's modification was more practical than the Barraquer method. Less time was consumed in the operation and the simplicity of the instrument was less likely to induce excitation of the patient. Dr. Schwenk, however, felt that should he himself require an operation for cataract, he would select the combined method of extraction.

Dr. Burton Chance said he had witnessed the first and nearly all of the subsequent operations in Dr. Parker's series prior to Prof. Barraquer's visit. The simplicity of Dr. Parker's procedure is the marvel of it, and, contrasting that simplicity with the complicated and likely-to-be-uncertain mechanical vibratory-suction apparatus of the Spanish surgeon, one is all the more attracted to it. Of course, at this day, one might well hestiate to utilize one's mouth as an adjunct to the power of any instrument to be inserted into the eye. Dr. Parker is working on a bent-glass tube to hold sterile water which shall enable the operators to perform the operation under aseptic conditions. It is astonishing what power the vacuum exerts, for the cortical zone of the lens is drawn into the cup of the cannula, as might be seen to take place by noting the prominence remaining on the surface when, for any reason, the cannula has been separated from the lens.

Dr. S. Lewis Ziegler commended Dr. Parker's ingenious modification of Barraquer's technic and also his simple suction instrument, but suggested the addition of a miniature ball valve like that of Redard, to prevent fluids from the operator's mouth trickling down into the patient's eye. It would also be an improvement to add a clear glass tube, as the handle of the suction tube. The instrument could then be used to aspirate soft cortex, as is

done so freely in Paris, where simple extraction with Kalt's suture still holds sway.

Dr. Leighton F. Appleman asked whether, in view of the unsatisfactory visual results obtained in those patients operated upon by Barraquer while in this city, Dr. Parker had obtained better visual results with the intracapsular method which he uses.

An Experimental Study of the Pathogenesis of Quinin Amblyopia, with Special Reference to Ethylhydrocuprein Hydrochloride

Dr. T. B. Holloway stated that Dr. A. E. Forster, of Kalamazoo, Mich., during his second year of study in the Graduate School of Medicine of the University of Pennsylvania, had made the experimental study that he was about to present. Shortly after the completion of his second year an illness from which he had been suffering became aggravated, and he died August 24, 1922.

In this study Dr. Forster gave a *résumé* of the literature pertaining to this subject and the results of his animal experiments, which were conducted in Dr. Kolmer's laboratory. In this study, quinin and urea hydrochloride and ethylhydrocuprein hydrochloride were the substances used. He arrived at the following conclusions: Rabbits were able to tolerate enormous doses of quinin and urea hydrochloride and ethylhydrocuprein hydrochloride without showing any special signs of intoxication. This tolerance was demonstrated by the fact that all rabbits, those receiving the largest as well as those receiving the smallest doses, apparently enjoyed the same health and retained their same approximate weights. The second group received a much larger total amount within a comparatively short period. It is noteworthy that during the entire period of the experiments that none of the rabbits ever exhibited any corneal anesthesia, dilatation of the pupils, ischemia of the retina or constriction of the retinal arteries, evidence of visual disturbance or any other ophthalmoscopic changes in the fundus. Microscopically, the first group

showed perivascular infiltration of mononuclear and plasma cells in the cerebrum in three cases and to a less degree in one case in the cerebellum. In all other cases the pons, cerebellum and optic nerves were negative. In the retina the ganglion cell layer in all cases showed marked changes, such as vacuolization of the cell, protoplasm and nuclei, the breaking up of the chromatin, the loss of the nuclear wall and the extrusion of its contents, the loss in staining properties, the decrease in the number of ganglion cells and the appearance of hyaline-like bodies. The second group showed similar changes, with the exceptions of rabbits Nos. 8 and 10, which received toxic doses; these two also showed changes in the pyramidal cells of the brain, such as a marked loss of the chromatin in some nuclei, a decrease of Nissl granules and a partial or complete loss of cell outline. The fact that the cellular changes in the normal specimens were so inconsiderable leads us to believe that the changes found in the above experiments were due to the toxic influence of the drugs employed.

Dr. Burton Chance said that the Section is indebted to Dr. Holloway for presenting this interesting paper, and the reading of it should serve as a memorial to a faithful student. It is to be lamented that one who gave such promise should have been cut off so untimely, and we all honor the bravery of the man who must have endured great pain in the last days of his life.

The Mechanism and Uses of a Variable Five-minute Test Letter

Dr. J. Monroe Thorington (by invitation) said in the usual methods by which test cards are used for recording vision and as an assistance to refraction, several common difficulties are met with:

1. The largest letter of the test card, at the standard distance, falls without the patient's visual range.

2. It is difficult to maintain a patient's attention upon a given single letter, and therefore the benefit of a sharp end point of refraction is lost.

3. There is at present no quantitative standard illumination for test cards.

4. In the determination of astigmic axes, special tests, not available in the test card, are required.

5. Test letters, as such, are not a precise test of visual acuity; thus some letters in a given line are more easily visible than others.

An apparatus was demonstrated, resulting from experiments carried out in the hope of obviating some of the above-mentioned difficulties. It was desired that a standard five-minute letter be arranged in such a way that variations in size from a vanishing point to a 20/400 size might be possible. Such an expanding object is exemplified by an iris diaphragm which is gradually opened.

The letter V was selected because of its simplicity. A set of five screens was then devised to reproduce the outline and a mechanism calculated and added so that the differential movement of the screens at all times outlined a five-minute V, the construction squares having a common center which is the theoretical vanishing point. By turning a handle a simple mechanism causes variations in the size of the letter.

Behind the screen opening is placed a ground glass, and back of this a standardized lamp of the type described by Ferree and Rand.[1] The entire device is arranged for rotation about its central axis, the vanishing point of the letter. The letter itself is calibrated in the foot and metric systems, a moving indicator indicating its size at any given time.

We have, therefore, an experimental instrument permitting a range far beyond that of existing test cards:

1. The variable size of the letter permits its use, in its larger range, for the recording of defective uncorrected vision, ordinarily without the range of test cards.

2. In its smaller ranges the letter may be used as a fixation object for the end-point in refraction estimation. An entire refraction may be carried out with this single letter.

[1] Am. Jour. Ophth., iii, 335, 409.

3. The device makes possible a test object possessing a variable and measurable standard of illumination.

4. Arranged for rotation about its central axis the letter gives results similar to those obtained in the Maddoc V-test for astigmia.[2]

5. As a variable test object with standard illumination, the letter may be used with precision as an index of visual acuity.

NOVEMBER 16

Sarcoma of the Lid: Preliminary Report

Dr. Charles E. G. Shannon exhibited a case of primary sarcoma of the lid in a woman, aged seventy-nine years. Family and personal history negative. Physical examination negative. She first noticed a small swelling at the inner third of the upper lid, O. D., about two years ago. This swelling slowly increased in size. Six months ago the tumor, presumably a chalazion, was incised, following which the growth enlarged very rapidly until it assumed its present appearance.

The skin surface of the lid is distorted and of a dark red color, in which dilated veins are observed. On eversion of the lid a large, irregularly shaped, broadly pedunculated mass is noted in the outer two-thirds while the inner third is occupied by a fairly large resistant swelling. The surface of the tumor is granulated and tends to bleed on manipulation, and is bathed with muco-purulent material. The scleral conjunctiva shows no invasion of the growth. The cornea is maculated, with a reduction of vision to 10/200.

Dr. Crawford, pathologist of the Jefferson Hospital, reports a mixed-cell sarcoma.

In view of the history of the case a diagnosis of primary sarcoma of the lid seems warranted.

[2] Am. Jour. Ophth., lv, 571.

While excision of the growth may ultimately be necessary, Dr. Hansell has advised *x*-ray treatment every four weeks.

Gunshot Wound with Fragment of Finger Lodged in the Globe

Dr. Chapin Carpenter (by invitation) reported an unusual result of a gunshot wound of the eye. A hunter laid his gun on a fence, from whence it was dislodged and discharged, with the full force of the charge passing through the fingers of the left hand, about a foot and a half from the man's face. An extensive wound of the globe resulted and the patient was advised to have immediate enucleation. This was refused for twenty-four hours, at which time the anterior chamber had cleared sufficiently of the blood to show a foreign substance protruding into the anterior chamber. Enucleation was then done and in the globe was found a piece of bone from the finger of the patient's left hand, 15 x 8 mm. An *x*-ray picture had been made without the foreign body casting any visible shadow. The bone was lodged in the vitreous and protruded into the anterior chamber, and had dislocated and shattered the lens. Its origin was from the first phalanx of the index finger.

In spite of the extensive injury the eyeball was not collapsed and the patient could see light for a few hours after the injury. The negative *x*-ray report, together with these features, made the case more than of usual interest.

Complete Discission for Traumatic Cataract

Dr. Wm. Zentmayer showed a patient on whom he had performed discission of the lens for traumatic cataract after the manner suggested by Dr. Ziegler. No difficulty was experienced in making a V-shaped through-and-through incision in the lens. The upper portion of the triangular lens mass tilted forward and

some of the cortical matter dropped into the bottom of the anterior chamber. The absorption of the lens was rapid in comparison to that following the ordinary method of discission, so that today, nine days after the operation, the lens has almost entirely disappeared. There was little reaction until today, when a hemorrhage appeared in the anterior part of the vitreous.

Dr. S. Lewis Ziegler suggested that in making a peripheral incision of the capsule or lens with the knife-needle the edge of the ciliary processes might protrude farther than usual and be punctured, causing a sharp cyclitis, with or without plastic exudate. An experience of that kind had caused him to make a slight change in his technic in order to obviate this. Instead of poising the knife-point over the capsule and making a dart-like thrust, he now lays his knife-needle on the tissue, presses it down toward the optic disk and then makes the dart-like thrust, thus escaping the danger of wounding the ciliary body. Of course, the pouring out of the traumatic cortex may have originated the slight exudate in this case. He would suggest the use of ice-pads, leech and calomel, together with hypodermic injection of mixed infection phylacogen, 2 cc on alternate days.

Dr. Zentmayer, in closing, said he did not believe that the late appearance of a hemorrhage could be attributed to any injury to the ciliary body at the time of the operation.

A Case of Myxosarcoma Involving the Left Orbit: Operation by Electrocoagulation

Dr. Edwin B. Miller presented for Dr. Luther C. Peter a boy, aged six years, seen at the Polyclinic Hospital, June 21, 1922, with the appearance of an abscess of the lower and inner aspect of the left orbit of five weeks' duration. The eye was pushed up and out, but was not involved. The *x*-rays showed frontals poorly developed but clear, as were all other sinuses. There was an unerupted tooth in the left canine area, in an unusually high position; this the roentgenologist thought might be the cause of the swelling under the orbit. Physical examination by the

Children's Department was negative. Von Pirquet and blood Wassermann negative. Leukocyte count, 5000.

On June 23, under ether, the area which appeared to be pointing was freely opened, but no pus was obtained. The orbit was carefully explored with a groove director, without results. A rubber drain was inserted.

Feeling that a pus pocket might have been overlooked, the wound was reopened and enlarged five days later and the entire orbit explored. Dr. Schatz, from Dr. Butler's service, was called in and he removed the inferior turbinate and the anterior end of the middle turbinate and curetted out the ethmoids, which were found to be necrosed. A free opening was made from the orbit to the nose and a drain inserted. The material from this area in the orbit was examined and reported as granulation tissue. After the second operation the proptosis markedly increased, the eye pushed up and out, the disk became blurred and swollen, the vitreous hazy and the cornea steamy.

Dr. Wm. T. Shoemaker saw the case in consultation and a tentative diagnosis of sarcoma was made. Leukocyte count, 14,000. Under ether anesthesia the contents of the orbit were eviscerated by Dr. Wm. L. Clark by the electrocoagulation method. The orbit was dressed with dichloramin-T, but as this was irritating, gentian violet was substituted.

The child made an uninterrupted recovery. Parts of the upper lid were not destroyed. In October the remaining lid was split, the cartilage was removed and the skin used to line the orbit, leaving a smooth, clean surface. There has been no sign of recurrence.

Examination of the mass containing the eyeball was obtained from two pathologists, one reporting small round-cell sarcoma and the other myxosarcoma.

Case of Herpes Zoster Ophthalmicus

Dr. Wm. J. Creighton reported the following history of a middle-aged, well-nourished, apparently healthy white male. There

was no history of any definite cause, such as exposure to cold, dampness or the taking of arsenic. He had a left-sided intercostal herpes five years before.

There was intense darting neuralgic pain in the left eye and the region of the left eyebrow and forehead over to the median line, up the left side of the scalp and down the left side of the nose from the root to the tip. There was an eruption of vesicles, numerous in number, of variable size, ranging from a pin-head to that of a pea. These were situated on inflammatory bases and were scattered over the above areas more or less in chain formation. There was redness and edema of the upper lid, with a chain of vesicles most marked horizontally just above the lid margin. Swelling and injection of bulbar conjunctiva, with excessive lacrimation and several small hemorrhagic areas. The cornea showed diminished sensation as compared with the right eye, and there were four or five superficial erosions or ulcers and a grayish infiltrate in the center occupying the superficial and deeper layers; these areas stained readily with fluorescin. There was a mild iritis associated, which readily dilated to atropin. The ophthalmoscopic examination, aside from the corneal involvement, was negative. The tension was normal.

As to general examination, the heart and lungs were normal; blood-pressure: 140 systolic and 85 diastolic; urine negative except for a small trace of indican; Wassermann negative; blood picture negative, the hemoglobin being 85 per cent, and no malarial parasites were found in either the fresh or stained smears. Nose and throat examination was negative. *X*-ray of skull and sinuses negative of the teeth showed an abscess at the root of the second molar lower right.

As to treatment: Locally, for the skin condition, a paste of zinc and starch was used. Hot magnesium sulphate stupes, holocain and atropin and iodoform ointment and a bandage were used early in the eye, later atropin and dionin. Generally, purgation, quinin and phenacetin were given early, but the pain was so severe that morphin had to be given. As the pain lessened

a prescription containing phos. zinc, strychnin and quinin was employed.

At the present time the patient presents numerous scars and pits, most marked on the forehead and scalp, where there is also some loss of hair. The cornea still shows the central opacity, which is gradually clearing and is somewhat anesthetic. The irritation, both conjunctival and ciliary, is very much less. The tension is now below normal.

Dr. John T. Carpenter referred to the modern view that herpes zoster ophthalmicus was to be regarded as an infectious specific disease, possibly showing particular selective action on the Gasserian ganglion. In addition to the local measures used in the present case, he had recently had a remarkably rapid and favorable termination in an unusually severe case of herpes zoster from the administration of large doses of quinin, in accordance with the old-time clinical practice. The prompt cure in this case was not due to any malarial toxemia, which was absent, as in Dr. Creighton's patient.

Dr. Wm. Zentmayer said that in herpes zoster ophthalmicus there were two complications which were of interest and which appeared to be absent in Dr. Creighton's case. In some of these cases, after the efflorescence has subsided, a paralysis of one of the ocular muscles develops, the third most commonly and the fourth rarely. Several views have been advanced to explain this. Head and Campbell found hemorrhages in the Gasserian ganglion, while another observer found thrombi in the ocular muscles.

The second complication is glaucoma, and this has been observed frequently enough to have been the subject of a report by Weeks, of New York. Just the opposite condition of hypotomy may occur.

Finally, there is some diagnostic interest in that the corneal lesion often bears a morphological resemblance to disciform keratitis. Of course, it has no relation to this disease other than that they may both have a neuropathic origin.

Dr. William G. Spiller said in some of the cases of herpes zoster

ophthalmicus the sympathetic fibers to the eye are affected, although they were not paralyzed in the case presented this evening. It is probable that these fibers reach the eye from the Gasserian ganglion through the first division of the fifth nerve. Dr. Dorrance has reported that when he injected the Gasserian ganglion with alcohol he observed flushing of the ophthalmic nerve distribution.

Nearly thirty years ago, Dr. Spiller had the opportunity to determine that in a case of Pott's disease a herpes zoster in the distribution of the second thoracic nerve was associated with miliary tubercles over the spinal ganglion of this nerve, and the first thoracic spinal ganglion which had been removed by mistake was normal. Disease of the spinal ganglion, or of the Gasserian ganglion in the case of the fifth nerve, may be the cause of herpes zoster.

Dr. S. Lewis Ziegler stated that he had once suffered from a mild attack of herpes of the left eyebrow after exposure to a nocturnal draft of cold air, followed by a day's ride in a European train with exposure to similar drafts. There was also a marked swelling of the nasal tissue but without discharge. The pain was of a dull, boring character. The cornea was not involved. The attack promptly yielded to the administration of hyoscin, morphin and pilocarpin, together with intranasal applications.

As a coincidence, he had met on the train today a patient who had once had a similar attack and had been relieved by the same treatment. It is well to have "several strings to one's bow," therapeutic or otherwise.

Some Ocular Phases of Little's Disease

Dr. Wm. Campbell Posey said that in 1861, Little, a British orthopedist, was the first to call attention to the condition not infrequently observed in consequence of premature birth, mechanical injuries during parturition to the fetal head, etc., in consequence of which convulsions are excited after birth and are

succeeded by a determinate affection of the limbs of the child. Little designated this disease as "spastic rigidity of the limbs of newborn children," although it is now usually designated as "Little's disease."

Dr. Posey gave a *résumé* of the neurological aspects of the disease, calling attention to the early involvement of the muscular system, chiefly manifesting itself by the difficulty of separating the thighs, the lower limbs being held stiffly, the thighs rotated inward, and so strongly adducted that the knees touch each other and in walking rub against each other. The arms are involved in many cases, but in others completely spared. In pure cases of spastic paresis of the lower or of all four extremities, Oppenheim points out that the symptoms must correspond completely with those of spastic spinal paralysis, and that there must be no indication of nondevelopment or incomplete development or degeneration of the spinal pyramidal tracts. In such cases other symptoms are generally present, which reveal the cerebral origin of the disease. Among these are ocular symptoms, disturbance in speech and sometimes difficulty in swallowing, convulsions and epilepsy. Strabismus is the most constant of the ocular symptoms. Feer found it in 30 per cent of the cases which were without cerebral complications, and in 40 per cent where such was the case. Although thought in most cases to be merely a concomitant squint due to errors of refraction, Dr. Posey stated that a study of the literature showed marked degrees of emmetropia in so few cases that we must assume that the deviations are due in most instances to innervational disturbances produced by the disease, and that they vary in degree and kind according to the location and extent of the cerebral lesion. Spasticity of the eye muscles, such as occurs in the extremities, is rarely present.

Nystagmus occurs next in relative frequency. Paralysis of the eye muscles and optic nerve atrophy are very rare:

Case I was that of a young man presenting all the classical symptoms of Little's disease, with convergent strabismus. The

disease had resulted from a very prolonged labor, the child being born in a condition of asphyxia pallida. Spasticity of the eye muscles was absent. Advancement of both externi under ether corrected the deformity.

Case II was that of a girl twin, who presented the rare anomaly of anotropia, both eyes rotating upward under cover. Convulsions appeared after the first examination of the eyes, which was made when the child was about five years old. In common with her sister, the patient had a somewhat spastic condition of the muscles of the lower part of the face and a peculiar manner of speaking. Dr. Spiller studied this case and made the diagnosis of Little's disease. He rendered a similar diagnosis in case III:

Case III, was that of a young man whom Dr. Posey had followed since infancy, with nystagmic movement of both eyeballs, most marked in lateral excursions, and slight tremor of the head. The ocular conditions had resulted from a prolonged labor and were attended with other signs of faulty development.

Dr. Wm. G. Spiller said, although Little expressed his views clearly in a paper in 1861, and had indeed made them known in 1853, we are still in some uncertainty as to what we shall include under the term Little's disease. Little included all the conditions which occuring before birth, at the time of birth or shortly after birth were capable of producing spastic paralysis of the limbs. He included cases of premature birth, cases resulting from asphyxiation during birth, cases from injury to the head during birth or shortly after, cases with mental impairment (even idiocy), cases with convulsions, etc. Brissaud attempted to exclude the cases with convulsions or disturbance of intellect, but this is not what Little intended to do. Van Gehuchten even desired to limit the term Little's disease to cases of premature birth.

The brain of a newborn child at full term is soft and imperfectly medullated, and when slight trauma occurs it is capable of producing grave disturbance. Asphyxiation may arrest the develop-

ment of cortical nerve cells, and it is surprising that it does not more often cause optic nerve atrophy. There is a patient in the Philadelphia Hospital who in 1903 had a severe loss of blood, so that his red cell count was a little over 1,000,000 and his hemoglobin 16 per cent. Shortly after the hemorrhage occurred he began to lose his sight and has had optic atrophy ever since. After sight was lost be became paralyzed in the lower limbs, and three months later was paralyzed in the upper limbs. He has regained the power of his limbs. In this case the effect of disturbed circulation on the optic nerves was clearly shown.

When a child is born prematurely the nerve fibers do not become properly medullated after birth, and incoördination results. He believed that the strabismus and nystagmus frequently seen in children born prematurely is to be attributed to incoördination produced in this way, as the cortex has very imperfect connection with the nuclei of the ocular nerves, and incoördination must result.

Spastic diplegia may be associated with arrest in the development of some part of the brain in addition to that of the motor fibers. There might be a failure of development of the visual system, as in a case reported by him many years ago. When lesions have developed in various parts of the cortex, as from trauma, different forms of visual disturbance are possible, provided the visual system is implicated.

In some cases of spastic diplegia the pons seems to be especially affected, as noted chiefly by Oppenheim, and in these cases paralysis of nerves to ocular muscles might readily occur.

It is a question whether it would not be better to drop the term of Little's disease and speak of congenital spastic diplegia. This condition has been known to exist from high cervical lesions. The term Little's disease owes its popularity especially to French writers.

Toxic Amblyopia with Retinal Hemorrhage

Dr. Wm. Zentmayer presented J. H., white, aged fifty-four years, laborer, examined at Wills Hospital, November 8, 1922,

complaining of failing vision, his condition having grown steadily worse during the previous two weeks. Has been a heavy drinker for thirty-six years, and for the past four months has drunk from one to one and a half pints of whisky, denatured alcohol and gin daily. Has smoked and chewed tobacco, on an average of six ounces a week, for forty years. Vision: O. D., 2/LX; O. S., 1/LX.

Aside from arcus senilis the external examination of the eye is negative. Pupils measure 3.5 mm. and react normally to light and convergence.

O. D.: Media clear. Margins of disk indistinct, temporal half shows atrophic pallor. Veins are irregular in caliber. Inferior temporal vein is large and tortuous. Arteries are too bright.

O. S.: Media, disk and vessels as in O. D. About 4 dd. diameter from the disk along the superior temporal vessels there is a pale hemorrhage about ½ dd. in size and in part overlying the vein.

Visual fields: O. D.: Form field normal. Color field somewhat contracted. Central scotoma, 35° x 25°, extending 20° toward the blind spot and 15° nasalward. O. S.: Form field shows contraction, especially on nasal side. Color field somewhat contracted. Central scotoma, 30° x 25°, extending equidistant on each side of fixation.

In both eyes the scotoma could be detected with 0.17° white test object. The scotoma indicated is mapped with 1° red test object. There is a central scotoma for a blue stimulus of very small visual angle, but not for blue of 1°. Color field limits had to be mapped with 2° test object, although 1° was sufficient for white. (Fields taken by Dr. Monroe.)

Physical Examination. Heart sounds normal. Radials firm but not distinctly sclerosed. Pulse, 84. Teeth in good condition except for pyorrhea and two stumps. Patellar reflex, Romberg and gait normal. Slight tremor of hands when arms are extended.

Treatment has consisted in sweats, laxatives, nitroglycerin and strychnin. There has been little improvement in vision. The retinal hemorrhage has all but disappeared.

The history of this case suggests that it was one of ethyl-methyl-

alcohol-tobacco amblyopia. Interest attaches to the presence of retinal hemorrhages in amblyopia as to the possible bearing of arteriosclerosis in determining the toxic effect of these agents upon the retina and optic nerve.

Reviewing the cases reported, the observations of Scalinci and Krüger as to the frequency with which instances of arteriosclerosis are found in toxic retrobulbar neuritis, together with the histological observations of Sachs as to the presence of a proliferating endophlebitis, a periphlebitis and a choking of the peripheral capillaries with small extravasations from them, lend support to Scalinci's view that arteriosclerosis is the factor determining whether these agents will affect the optic nerve and retina, and also explains individual susceptibility.

Dr. Wm. Campbell Posey said that although very pronounced cases of toxic amblyopia were uncommon, those of lesser degree, in consequence of which vision was but slightly reduced, were comparatively common. Such were the cases where, in addition to the toxic agent, there was a general arterial sclerosis and faulty elimination from defective renal or intestinal action. In addition to the torpor retinæ present in such cases, the ciliary muscles seemed to him to be implicated also, as so many of his cases of this nature exhibited such frequent changes in spherocylindrical combinations and axes until the toxic source has been removed by suitable measures.

An Interesting Case of Papillitis

Dr. L. F. Appleman reported a case of papillitis with the history of having noted failing vision, becoming progressively worse, for the past six years. When first seen his vision was 6/15 in each eye. Both optic disks were swollen to the extent of about three diopters and occupied an area about twice the size of the normal disk; the borders were completely obliterated. The visual fields showed beginning contraction for form and colors, more marked in the left eye.

He denied venereal infection, and the subsequent Wassermann report was negative. No trouble was complained of which was referable to his nose or sinuses. He admitted that his teeth were bad, as could be seen upon inspection.

Following the extraction of twelve teeth and roots a most remarkable improvement occurred in his ocular condition. Within four months his vision improved to 6/6 in each eye; the swelling of the optic disks disappeared; the outlines became clearly visible and the color greatly improved. When last seen he stated that he felt better in every way and had passed two tests for employment on the railroad.

It was pointed out that this lesion was rare in association with dental infection, although inflammations of other ocular structures were comparatively frequent.

Indirect Rupture of the Sclera, with Report of a Case

Dr. Aaron Bray (by invitation) exhibited a boy, R. G., aged thirteen years, who was brought to the Jewish Hospital, July 27, with the history that while sitting on a coaster wagon in an ice plant an iceman attempted to put a piece of ice on his wagon, but the tongs slipped and hit him a heavy blow on the left eye. Examination six hours after the injury showed the left upper lid slightly edematous, with a horizontal linear superficial cut which was clean, and involved only the superficial layers of the epithelium of the skin; cornea clear; anterior chamber shallow; pupil oval, fixed, drawn upward and adherent at the upper limbus; the anterior chamber contains some blood; vision reduced to light projection. At the upper corneal scleral margin was a laceration of the conjunctiva and sclera, the rupture in the shape of an inverted letter T, the horizontal line about 5 mm., the vertical line about 8 mm. No tissue protruded from the wound. The choroid was visible and intact; the eyeball was soft.

Three intramural stitches were inserted in the conjunctiva, one stitch horizontally and one on each side of the vertical tear.

Atropin was instilled and a bandage was applied. Two days later the anterior chamber was clear, the pupil dilated and light projection good. Ten days after the injury the eye was quiet and practically free from inflammation, with only the site of the wound injected; vision improved; wound healing with pigmentation in the gap, where one of the sutures failed to hold.

On September 25 the eye was quiet and no injection at site of the wound; media clear and disk oval, well defined and of good color; no changes in the retina. Vision with correcting lens, 56. Slight pigmentation in cicatrix.

PROCEEDINGS

OF THE

SECTION ON OTOLOGY AND LARYNGOLOGY

JANUARY 18

A Case of Post-tonsillectomy Pulmonary Abscess

BY GEORGE FETTEROLF, M.D.

This case is put on record on account of the present-day interest in pulmonary abscess as a sequel to tonsillectomy. Death occurred on the forty-second day after operation.

The patient was a man, aged thirty-three years, the high spots of whose history are: Much earache in childhood; a heart murmur of at least seventeen years' existence; "blind boils" on the neck almost all his life; a positive Wassermann reaction; rheumatism, especially in the spinal region, and agonizingly severe headaches. The heart lesion was an aortic regurgitation, the systolic blood-pressure being 124 and the diastolic 40. The murmur was a very loud one and could be heard all over the heart region. There was a marked Corrigan pulse. Compensation evidently was well established, as the patient could hunt all day in the Rocky Mountains, at an elevation of 10,000 feet, and finish the day as fresh as would his guides.

He was a patient of Dr. B. B. Vincent Lyon and of Dr. Judson Daland, and in the search for a focus for certain of his troubles, Dr. Daland referred him to me for examination. My report was as follows:

"There is a small amount of mucopus in his nose and some swelling of the turbinates, but nothing to indicate that any of the sinuses are involved. By transillumination both antra are rather dark, but equally so, and the shadows are not sufficiently dense to indicate the presence of fluid. The frontal sinuses transilluminate clearly, the right a little bit more so than the left. Posterior sinuses are negative. My examination this morning would justify me in stating that his sinuses are probably not responsible for his headache. The tonsils are large, chronically congested and the seat of a chronic septic process. These are a very probable focus for absorption. The rest of his upper air passages are negative."

On reviewing the case Dr. Daland and I advised tonsil operation, knowing and stating the risks, among the latter being a thickened condition of the walls of his arteries and the history of a profuse arterial epistaxis to the estimated amount of a quart. The blood coagulation time was taken and found to be normal. Urine was normal.

Operation under ether was performed on October 15, 1917. Following the removal of the right tonsil the hemorrhage was very severe. The usual attempts were made to stop it, and these were not successful. There could be seen a pulsating stream of blood high up in the fossa, but it was impossible to secure the artery. After about one-half hour's work two sutures were passed through the pillars and fastened with perforated shot over a large gauze pad. As the pad seemed to fit rather loosely in the fossa several extra pieces of gauze were tucked in below it, under the lower suture. Bleeding continued freely, the blood coming out at the lower part of the fossa and through the stitch holes. Another pad was pushed in at the lower end and held with the finger, thus exerting direct pressure on the lower part of the cavity and also forcing up more tightly the upper pad. Under this treatment the hemorrhage gradually slowed up and the finger was replaced by a clamp. After about an hour the bleeding started again and the sutures were cut and the pad removed. The hemorrhage was now very active and came from

the same point as before. It being impossible to secure the vessel the anterior palatine arch was deeply cut into so as better to expose the upper part of the tonsil recess. I then was able to catch the vessel with a hemostat. A ligature was put on and this immediately cut through the tissue. Again the vessel was caught in a hemostat and again the ligature cut through the tissue. The bleeding was now worse than ever and the gush of blood was so great that it was impossible to see the vessel. A hemostat was applied through the blood and a big bite of tissue grasped; fortunately in the tissue caught was the vessel, and the bleeding immediately ceased. A curved needle carrying catgut was passed deeply through the anterior wall of the fossa and out well up in the soft palate and the hemostat removed, after which the ligature was tied. This was about three hours after the operation was begun, the patient having been kept in the operating room all this time. He left the operating room about 5 P.M. At Dr. Daland's suggestion, about four o'clock, he was given a hypodermic of morphin, $\frac{1}{4}$ gr. This enabled me to do whatever work was necessary in his throat without the administration of any more ether. On account of the hemorrhage and the condition of the patient no attempt was made to remove the left tonsil. Before the patient left the operating room his blood was examined and it was found that his hemoglobin percentage had dropped from 76 to 56.

On visiting him at 8 P.M., I found the intern working on his throat and a pus basin literally full of bright red blood at the side of his bed. This time there was a spot about 1 cm. sq. at the base of the fossa slowly oozing. This was readily checked with a 10 per cent solution of silver nitrate and there was no further trouble from hemorrhage. Estimated amount of blood lost was between two and three quarts.

The patient remained in the hospital for three days and then returned to his home. His temperature ranged around 100°, but otherwise his general and local convalescence progressed favorably.

His headaches continued with great severity and at times he was delirious. There was also a slight dry cough. On October

20, five days after operation, his hemoglobin was 58 per cent, his leukocytes 11,600 and his erythrocytes 2,880,000. On October 21, six days after operation, his leukocytes were 13,000. His temperature from this time on was of a distinctly septic type. On the fifteenth day after operation it reached 104.2,° on the twenty-third day 104° and on the fortieth day 104.3.° On the intervening days it varied from 100° to 103°.

About midnight on October 20, five days after the operation, I received word that the patient was having a nose-bleed. Examination showed a septum concaved to the right and a point which had bled at the usual location just behind the vestibule. Bleeding had ceased when I arrived and not more than a half-dram had been lost. I remained with him all night, but no further trouble ensued.

On the afternoon of Tuesday, October 23, eight days after operation, I was called on account of bleeding from the throat. On arrival, about an hour later, everything was found to be quiet. About half an ounce of blood had been lost. On looking into the throat some loosely adherent post-tonsillectomy membrane was seen in the right fossa, but no blood nor area of fresh tissue from which the blood could have come. Some dark, partially dried streaks were seen on the posterior wall of the pharynx extending up above the soft palate. This probably was pulmonary in origin.

About 7.30 on the same evening I was called again on account of a vigorous coughing attack and the spitting up of some blood and putrid material. On arrival I found about 2 dr. of foul-smelling, blood-tinged material, and the patient in a badly shocked and frightened condition. He said that he was "all in" and that an abscess in his left chest had broken. In this statement he probably was entirely correct. When I examined his throat at this time I found the fossa for the first time to be entirely free of membrane. On account of the patient's condition of excitement, both mental and physical, I ordered a hypodermic of morphin, $\frac{1}{6}$ gr. Shortly after receiving this his pulse improved very much in rate and volume and he had a thoroughly quiet and comfort-

able night. On the following morning his rectal temperature was $99\frac{1}{5}°$, the first time it had been below 100° since the operation. I spent the night of October 23–24 in a room adjoining his, but there was no need for me at any time.

From then on the patient's general symptoms were septic in nature. The throat gradually cleared, finally healing normally.

Dr. Daland's notes of the further clinical history are as follows:

"At the expiration of about a week a few fine mucous rales were audible in the neighborhood of the right margin of the lower lobe of the left lung, unaccompanied by dulness on percussion, increased fremitus or resonance. The rales slowly and gradually increased in number and size and the feeble breath sounds became bronchovesicular. The opinion was expressed that this lung was the seat of septic pneumonitis, preparatory to the formation of an abscess. The lung in the adjacent territory gave evidence of congestion. Cough became more frequent, later purulent, and occasionally the sputum expelled, and likewise the breath had a putrescent odor. In the beginning it was difficult to differentiate between the odor which might have had its seat in a sloughing of the usual membrane in the throat and the pulmonary condition, and in the beginning it was hoped that the septic phenomena were largely due to absorption from the throat. Later the traumatized throat healed, the cough and the amount of expectoration gradually increased, became profuse, averaging from 4 to 8 ounces daily, a considerable portion of which was liquid, purulent serum or saliva. The cough became more frequent, interfering with rest and sleep. The septic fever and sweats also continued, and as there were no definite evidence by physical examination that a cavity existed it was decided to wait before resorting to surgical treatment."

Sputum examination on October 30, fifteen days after operation, showed the presence of many streptococci, a few encapsulated diplococci and many pus cells. No tubercle bacilli were found at this or any other time. Repeated blood cultures were negative.

"From time to time dry friction sounds were heard over the lower left lung in the region of its right border, also exocardial

friction sounds, and occasionally pericardial friction sounds were heard over the base of the heart.

"On November 17 weakness began to develop more rapidly, and on November 22 he was removed to the Jefferson Hospital. Dr. W. F. Manges made a roentgen-ray study, which in effect indicated involvement of the lower left lobe, and the distribution of the shadow was such as to incline me to the opinion that pleural effusions existed. Physical examination, however, showed no evidences of pleural effusion, but did show a marked extension of the disease and a septic pneumonitis involving the greater portion of the lower lobe of the left lung. In consultation with Drs. Da Costa and Fetterolf it was decided to aspirate the left pleural sac, and two punctures were made and no liquid obtained. In view of the absence of localizing signs indicating the presence of a definite cavity, together with the septic and weak condition of the patient, Dr. Da Costa declined to favorably consider the suggestion of introducing a drainage tube in that region of the lung first involved, which was believed to be the seat of an abscess. He recommended that Dr. Chevalier Jackson be consulted, with the hope of obtaining additional information by means of the bronchoscope. Dr. Jackson decided that no advantage to the patient could be expected from the use of this instrument. At this consultation I advised that on the following day the lung be punctured in different directions by means of an exploring needle, with the object of localizing the abscess, thereby giving the surgeon information which would enable him to intelligently operate to secure drainage.

"At about 11 A.M. on Saturday, November 24, the patient became extremely weak, sweating profusely; the physical signs of edema of the lungs manifested themselves, and when I saw him at 11.45 A.M. he had been venesected to the amount of 1 pint and had received hypodermic injections of strychnin, atropin and camphor oil. These injections were repeated; the pulse gradually increased in frequency, numbering 144 to 160 per minute, exceedingly thready; respirations were very rapid, about 52 per minute, and superficial, and the patient died at 4.50 P.M.

"An autopsy was performed at or about 6 P.M., November 24, the day of death, and revealed slight pleural adhesions over the right third of the lower lobe of the left lung, which adhesions were sufficient to prevent the lung from collapsing. When the thorax was opened the two pleural surfaces were easily separated by the pathologist. Laterally and posteriorly there were several strong adhesions, evidently due to an old pleurisy. When the lung was sectioned it showed a moderate-size, irregularly shaped abscess cavity filled with pus of a putrescent odor, and an ecchymosis of the surface of the pleura, directly over the abscess, showed where the needle had punctured; posteriorly there was a small, strong pleural adhesion which corresponded to the point of the exploring needle, which was introduced at a point corresponding to the left scapular line. If the needle had been pushed onward in this region for the distance of one inch it would have entered the abscess cavity.

"The condition of the heart corresponded to the physical signs with the exception that the aortic leaflets were not retracted as much as the physical signs indicated, although they showed fibrosis at the bases, as did also the mitral leaflets. The pericardium showed no inflammatory change. There was no effusion in the precordial or pleural sacs. The lower lobe of the left lung showed evidence of septic pneumonitis, and the occurrence of this extension of the disease makes it a question whether or not the patient would have recovered even though the drainage tube had been introduced into the abscessed cavity."

Comment. The notable features of this case which pertain to its lung abscess phase are the following:

1. The fact that the abscess occurred in a patient who was not a good operative risk, the unfavorable factors being low resistance to infection ("blind boils all of his life"), his luetic history, his aortic lesion, his low diastolic blood-pressure (40), his thickened arterial walls and his history of severe arterial epistaxis. It was only the imperative need for the removal of every septic focus that justified operation, and it is quite possible that had it not been for the prolonged anesthesia, the truly frightful hemor-

rhage and the unusual amount of throat trauma the patient would not have succumbed.

2. The prolonged anesthesia and severe hemorrhage, with their possibilities of inhalation of septic material, which could cause irritation and infection of the lung tissue.

3. The very unusual amount of trauma inflicted upon the throat in a three-hour effort to check the hemorrhage. This included a long deep-buried suture, which would afford a reasonable basis for the formation of a septic thrombus in the pharyngeal veins, which in turn could be the root of an embolic process in the lung.

4. The temperature elevation, which continued throughout the whole six weeks, from operation to death.

5. The leukocytosis, which was constantly present, ranging from 11,600 on the fifth day to 18,000, the maximum, on the twenty-sixth day.

6. The spitting of blood, evidently not from the nose or throat, on the eighth day.

7. The continued foul odor to the sputum and breath, especially significant in that it continued after the usual post-tonsillectomy exudate had disappeared.

8. The patient's voluntary statement on the eighth day, following a marked collapse attended by expectoration of a quantity of foul, bloody pus, that "an abscess has broken in my left lung."

A Review of Eighteen Cases of Pulmonary Abscess

BY WILLIAM O. H. PROSSER, M.D.
(By Invitation)

A search of the files of the medical division of the University Hospital for the past twelve years resulted in the finding of 18 cases of pulmonary abscess. While this disease has appeared extensively in the recent literature, 5 of the 18 had such direct bearing on diseases and operations involving the upper respiratory

tract that the writer was prompted to relate them before this meeting. Two of the 5 occurred in cases suffering from convulsions, 2 followed extraction of teeth and 1 was a sequela to tonsillectomy.

"The most common factor in a series of lung abscesses at the Massachusetts General Hospital,[1] according to Whittemore, was the precedence of an operation on the 'upper respiratory tract under a general anesthetic.' Out of 32 cases in which the etiology was definite, 17 were due to the removal of tonsils, 1 to the removal of adenoids only and 3 to the extraction of teeth, this giving a total of 21 cases, or 65 per cent due to this cause." Lord[2] says: "In 25 out of 100 cases, or 1 out of every 4, the cause may be definitely traced to operation about the upper respiratory tract. Pulmonary abscess followed operation about the mouth for cancer of the jaw, of the lip and of the tongue in 1 case each, the removal of tonsils or tonsils and adenoids in 12 cases, the incision of a peritonsillar abscess in 1 and the removal of teeth in 9."

The next most common cause of pulmonary abscess is respiratory infection of one type or another. In 89 cases of lung abscess from autopsy findings at the Bellevue Hospital,[3] New York, 29 followed bronchopneumonia, 18 lobar pneumonia, pyemia 15, septicemia 11, thrombosis of various veins 8, septic endometritis 7, infective endocarditis 6, and this will be of special interest to the present gathering, acute suppurative otitis media 5.

Norris and Landis[4] report 31 cases of pulmonary abscess compiled from autopsy records of the Pennsylvania Hospital in which bronchopneumonia was the etiological factor in 6 cases and croupous pneumonia in 3, while vegetative endocarditis caused 6, mastoid disease, thrombosis of the portal vein, thrombosis of the lateral sinus, otitis media and appendicitis 2 each, and abscess of the kidney, of the lip, of the pharynx, of the seminal vesicles and of the skin 1 each.

[1] Lung Abscess, Surgical Clinics of North America, June, 1921, p. 765.
[2] Quoted by Whittemore, W., loc. cit.
[3] Hartwell, John A.: Abscess of the Lung, Ann. Surg., September, 1920.
[4] The Diagnosis of Pulmonary Abscess, Tr. Assn. Am. Phys., 1913, xxviii, 302.

The 18 cases reported herewith can be classified as to their etiology as follows: Pneumonia 5 cases, extraction of teeth 2, convulsions 2, tonsillectomy 1, tonsillectomy and adenoidectomy with postoperative pneumonia 1, suppurative appendicitis 1, inguinal herniorrhaphy 1 and undetermined 5. There are therefore 13 of the 18 which have a definite etiology; 6 followed operations, and of these 4 were in the mouth and throat.

Of the 2 cases that followed extraction of teeth 1 already has been reported by Dr. O. H. Perry Pepper.[1] The history of the other is so typical as to be classic, and is as follows: The patient was a white man, aged fifty years, who on November 19, 1921, had twenty-two teeth extracted under gas anesthesia. He states that the majority of these teeth were loose and the associated pyorrhea was very severe. Two days after the extraction the patient felt so ill that he could not go to work. On the fifth day he noted the presence of pain in the posterior portion of the right axilla radiating down the right side and to the right shoulder. On the eighth day a very offensive odor to the breath was noticed, and on the following day, the ninth after the operation, he had a coughing spell and spat up a quantity of brown purulent material. Four weeks after the onset of these symptoms he was admitted to the hospital suffering from cough, foul expectoration and loss of weight. Aside from the lungs the physical examination was negative with the exception of a mild grade of secondary anemia and a leukocytosis of 13,000 with a differential of 81 per cent polymorphonuclear leukocytes. Over the right chest, posteriorly from the fourth dorsal spine to the base, there were distinct signs of consolidation. The sputum was purulent, slightly blood-tinged and very offensive. It contained pneumococci, staphylococci, many red cells and pus cells, but no tubercle bacilli. The roentgen-ray diagnosis was "abscess or gangrene of the upper part of the right lower lobe." On the second day after admission operation was decided on and a two-stage thoracotomy was performed. The abscess was found to lie deep in the

[1] Postoperative Pulmonary Complications with Three Illustrative Cases, Medical Clinics of North America, November, 1921, p. 737.

tissue of the right upper lobe. Drainage tubes were inserted into the affected area and at this writing the patient is discharging pus in decreasing daily amounts. He also shows marked general improvement.

The next 2 cases are of particular interest because of the unusual manner in which the infection was probably introduced into the lung parenchyma. Both of them suffered from convulsions and epileptiform seizures for many years prior to the development of their lung abscess. The first of these is a white man, aged forty-six years, with a history of perfect health until the spring of 1918, when he noticed soreness around the border of his right chest. About two or three weeks later he began to have coughing spells and expectorated thick yellow material of foul odor. He was put to bed for eight weeks and the trouble seemed to clear up, but three months later there was a return of the cough and of the foul bloody sputum. This patient had had convulsions for the past twenty-eight years, coming on mainly at night and attended by frothing at the mouth, but apparently did not bite his tongue. These convulsions occurred on the average of twice per month, but shortly before admission he had been having three or four per day.

On physical examination the chest was found to be normal everywhere except in the upper right axilla. Marked dulness was noted here with diminished breath sounds and many rales. The sputum was foul and contained pus and blood but no tubercle bacilli. The blood count showed mild secondary anemia with 10,000 leukocytes and 58 per cent polymorphonuclear leukocytes. The roentgen-ray examination revealed a "localized collection in the right side high in the axilla with probable rupture into a bronchus." Two exploratory punctures made over the affected area in the right upper axilla were negative for pus. Additional roentgen-ray studies confirmed the first findings as abscess in the lung. The patient improved rapidly during the two months following and was discharged, with physical signs practically cleared up.

This case did not go to operation so the diagnosis of lung abscess

cannot positively be made; but his history prior to admission and the physical signs, together with the roentgen ray and sputum findings, justify this diagnosis. The question is, Did he aspirate into his lungs some infective material or foreign body while in a convulsive seizure? This is a very possible occurrence.

The literature records cases that have developed aspiration pneumonia and pulmonary abscess with convulsions as the etiological factor. Carr,[1] of Chicago, states that "aspiration pneumonia, especially of the insane, is often the cause of lung abscess." Davis[2] cites an eclampsia case that died following an extraperitoneal Cesarean section. He states that: "The mother had fifteen convulsions after operation, a high fever and developed pneumonia. Autopsy showed gangrene and abscess of the lung and empyema. The same author refers to another case as follows: One eclampsia patient died of pneumonia through aspiration during her convulsions, as proved by autopsy."

The second convulsion case with pulmonary abscess is as follows: A white man, aged forty-one years, was admitted, June, 1921, to the medical wards of the University Hospital complaining of cough and profuse expectoration. The patient stated that in the fall of 1918 he began to have attacks of dizziness and would momentarily lose touch with his surroundings. These attacks were preceded by regurgitation of sour fluid into his mouth. On one occasion he fell to the floor and was unconscious for fifteen to twenty minutes and his legs and arms were seen to twitch. He had two or three major attacks a week, most of them at night. He never bit his tongue nor lost sphincter control. About two months before admission he fell a distance of approximately seven feet, alighting in a standing posture. He was severely shaken up but apparently uninjured, as he was able to continue his work for the remainder of the day. That evening, while attempting to arise from a chair, he was seized with a sudden sharp pain in his right lower chest. Coughing began immediately and he expectorated thick brown sputum of very foul odor. Attacks

[1] A Pulmonary Abscess following Tonsillectomy, Medical Clinics of North America, July, 1919, p. 209.

[2] Obstetrics, Prog. Med., September, 1921, p. 84.

of coughing with expectoration continued thereafter until his admission to the hospital. On some mornings he would cough up a half-cupful of purulent material. The patient declared this to be the first illness he had ever experienced.

On physical examination percussion was impaired in the lower posterior axillary region of the right chest; the breath sounds were distant and there were rales in the right axilla and lower right base. The sputum consisted of yellow mucus containing Staphylococcus albus, Micrococcus catarrhalis and a non-hemolytic streptococcus. The roentgen-ray report was, "Lesion of the right lung, about the middle, the exact nature uncertain; appearance suggests some cavitation." Further study of this case was cut short by the patient insisting on his discharge from the hospital. However, it is significant to note that the ward chief, Dr. Richard Kern, expressed his opinion to the doctor, who referred the case as follows: "The patient is suffering from two diseases: The one, epilepsy, with mostly minor attacks but with some of a major type. These may explain his falls. They may also explain his chest condition, for during an attack he may have inhaled a foreign body. The signs of the lung condition are those of a lung abscess communicating with a bronchus. The roentgen ray confirms this diagnosis."

The last case is one of pulmonary abscess following tonsillectomy: A white woman, aged thirty years, was admitted to the ward suffering from cough, expectoration and pain in the chest. The patient had had a tonsillectomy done and she recovered from the operation perfectly. Ten days after the operation she noticed pain in the lower part of her left chest accompanied by fever, chills and a few days later by cough and expectoration. She went to bed for three days and then was sent to another hospital, where she remained for two months. Following that she spent five months in the mountains, but without any marked improvement. Her condition compelled her to return to the city and she was admitted to the Universtiy Hospital suffering from cough and profuse bloody expectoration. She said she had never been ill before. Her chest was impaired to percussion

on the left side low down in the midaxillary line. Moist rales were heard. The roentgen-ray diagnosis was, "Lung abscess of the lower lobe on the left side." The patient received postural treatment for one month and an autogenous vaccine was made from her sputum. Her improvement was not marked, so it was decided to drain the abscess. Unfortunately she did not survive the operation.

The autopsy showed an abscess, the size of a walnut, in the upper lobe on the left side, situated on the lateral surface of the lung. There also was found an abscess cavity the size of a hazelnut at the base of the left lung. There was no communication between the two abscesses. The walls of the cavities were firm and fibrous and the surrounding lung tissue was congested and edematous. The abscess in the lower lobe communicated with a fair-sized bronchus.

Pulmonary abscess touches nearly every phase of medical activity and is of practical interest to the internist, the phthisiologist, the general surgeon, the laryngologist and the dentist. No operator can have foreknowledge as to when such an accident is to occur and therefore a familiarity with the various etiological possibilities is of value. That lung abscess can follow a convulsive seizure seems not to be widely known, and it is perfectly possible that cases which have been ascribed to other causes could, on a searching of the patient's history, plausibly be ascribed to this cause. That this condition so frequently follows multiple tooth extraction likewise seems to have escaped general notice. These two points combined with the writer's interest in the subject are what mainly prompted the preparation and presentation of this communication.

I wish to express my thanks to Dr. Alfred Stengel, chief of the medical service of the University Hospital, to whom I am indebted for permission to use the medical records of the cases herein discussed.

Report of a Case of a Cerebellar Abscess

BY C. C. EVES, M.D.

Case History.—I. N., male, aged twenty-nine years, was first seen in the office September 21, 1921.

Past History. Scarlet fever twenty-two years ago, followed by intermittent discharge from both ears. Right ear became totally deaf. At nine years of age he fell from a bicycle and injured his head. The attending physician said he had meningitis. Between the ages of fourteen and sixteen he had attacks of epilepsy.

Present History. Two weeks ago he became dizzy and vomited three days later. (He had had similar attacks but not so severe.) As this dizzy spell came on he noticed he became deaf in the left ear also, but this has improved. Two days ago he had a severe pain in the left ear, which was opened by his family physician, with a slight discharge resulting. Last night the ear started to ache severely, and this morning he had another vomiting attack. Had a decayed tooth extracted three days ago.

Fork Tests. September 21, 1921.

Right Ear.	Left Ear.
Watch-tick negative	Watch-tick negative.
1024 A. D. negative	1024 A. C. negative.
1024 B. C. positive	1024 B. C. positive.
512 A. C. negative	512 A. C. greatly diminished.
512 B. C. positive	512 B. C. positive.
128 A. C. negative	128 A. C. negative.
128 B. C. positive	128 B. C. positive.
Whistle negative	Whistle negative.

Summary of Fork Tests. Aerial condition negative; bone condition increased.

Personal Examination. Slight sagging of the superior-posterior canal wall. Small pocket of pus in the upper remaining part of M. T. M. T. destroyed except about upper one-eighth. Very slight purulent discharge coming from a minute opening in the remaining M. T. Tenderness over the entire mastoid area. The patient looked septic; had a temperature of 100°; pulse,

90. Was referred to the Pennsylvania Hospital. White cell count, 22,000.

Radical Mastoid. Performed September 21, 1921. The entire mastoid was ebonized until the antrum was reached. The antrum was of unsually large size with necrotic bone surrounding it. The cavity of the antrum contained free pus and cholesteatomatous material. The posterior-superior semicircular canal stood out in relief. The temporosphenoidal dural plate was exposed by the necrotic process and was rather dark in appearance.

The usual radical operation was performed. The bones of the middle ear were entirely destroyed by necrosis.

Following the operation the symptoms of pain, headache and dizziness disappeared. Twenty-four hours after the operation a partial facial paralysis came on which partially cleared up before the patient left the hospital, October 9, 1921. At this time the patient was feeling well and in excellent spirits, the temperature and pulse having been normal for about two weeks.

October 12, the patient complained of temporal headache with no other symptoms.

October 13, headache increased, becoming general; vomiting also occurred. The patient when asked where the pain was located passed his hand over his head beginning on the left temple over the left lobe and down the back on his neck. He refused to go back to the hospital.

October 14, the next morning he was so much worse, the vomiting and headache having increased, that he was sent to the hospital, where an examination was made. No vertigo, asphasia, nystagmus nor ataxia. No signs of meningitis. Pulse 46, temperature 100°. Eye-grounds negative.

Dr. E. G. Strecker was asked to make a neurological examination. His report follows:

"The case of brain abscess at the hospital was remarkable in that such marked cerebellar destruction existed without clinical evidence. Of course the patient's mental state prevented satisfactory examination, so that the typical signs of cerebellar disease such as difficulty of coördination, dysmetria, passed pointing,

etc., could not be tested for, yet even phenomena like nystagmus, oculomotor paralysis, spasticity, etc., which it was possible to examine for, were entirely absent. The only neurological sign was the undoubted Babinski, which is perhaps a little more common in a deep temporal abscess. The absence of optic nerve swelling was also unusual considering the size of the abscess. Choked disk is more frequent in cerebellar abscess than in any other location. I could not account for the lack of sensory aphasia, which is, of course, the most striking symptom of a lesion of the left temporal lobe. The attempt to localize the abscess was largely on the strength of the history, the fact that temporal abscess subsequent to ear disease is about four times more common than cerebellar abscess, the absence of choked disk and perhaps the Babinski. Oppenheim reports a number of cases of cerebellar abscess (autopsied) in which focal symptoms were entirely absent.

"In reviewing the case I think, in view of the lack of any positive temporal signs, I failed in not advising exploration of the cerebellum in case the probe of the temporal lobe proved fruitless, but the clinical signs did not seem to justify this."

Second Operation. October 14, the brain was uncovered over the temporosphenoidal lobe; several punctures were made into the temporosphenoidal lobe without finding pus. The patient's condition was not good; he was returned to the ward, where he died three hours later.

Autopsy Finding. October 16. Cerebellar abscess 3 x 3 cm. in the left cerebellar hemisphere, the walls of which were gangrenous in nature.

Presentation of a Case of Total Laryngectomy and Resection of the Upper Part of the Esophagus

BY FIELDING O. LEWIS, M.D.

Case History.—Mrs. A. E., aged fifty-nine years. Married.

Chief Complaint. Aphonia, dysphagia and productive cough. No night-sweats, chills or hemoptysis.

Family History. One sister died of carcinoma of the breast at the age of thirty-six. Otherwise negative.

Personal History. Is the mother of ten children. Has had three miscarriages. No operations.

Present Illness. Began nine years ago, while living in Russia, with "sticking" sensations in the left side of the throat. Diagnosis at that time was made of a growth in the throat, and operation was advised. The patient then migrated to America, was comfortable for several months, then reported to the Pennsylvania Hospital in 1914 and 1915, with recurrence of pain in the left side of the throat. Operation was again advised but refused. She then consulted the nose and throat department of another hospital and was treated regularly for two years. A piece of tissue was removed for study. The patient states that a similar operation was repeated four months later, under local anesthesia. There was no dyspnea until three years later, at which time she was referred to Dr. William L. Clark for treatment by radium. I was then asked to see the patient with Dr. Clark, and as operation was again refused the patient consulted another laryngologist, who advised tracheotomy, which was refused at that time, but was forced to have it performed two months later because of difficulty in breathing. Radium was again used internally and externally.

The patient then consulted me again at the office and operation for removal of the larynx was advised, to which the patient consented.

Examination. The patient is an illy-nourished white female. General examination negative. Wassermann negative. Roentgen-ray examination showed no evidence of metastasis in the lungs or mediastinum. No palpable glands in the region of the neck. Patient complains bitterly on attempting to swallow food and some discomfort complained of in the wearing of the tracheotomy tube. Laryngeal examination showed the entire larynx filled with an ulcerating growth.

The patient was admitted to the Jefferson Hospital, November 7, 1921. On November 11, under intratracheal anesthesia, the larynx was removed and the upper part of the esophagus was found in-

volved and was also excised. The remaining end of the esophagus was brought laterally and attached to the skin on the right side of the neck. A Rehfuss feeding tube was introduced through the esophagus and the wound dressed in the usual manner. The patient was given fluids and concentrated food every three hours. Her general condition became very much improved, and she was discharged from the hospital December 18.

Specimens Illustrating Operative Aural Surgery and the Making by Graduate Students of Preparations Showing Aural Surgical Anatomy

BY E. B. GLEASON, M.D.

The first problem to be mastered by surgeons who wish to undertake operations on the ear is a thorough understanding of the complicated topographical anatomy of this region. This cannot be acquired from text-books and is not readily acquired by an attempt to do these operations on the cadaver, even under competent supervision, unless supplemented by specimens especially prepared to show this or that relation of the anatomical structures involved in the operations. The knowledge comes from the actual making and frequent handling of such preparations during a cadaver course on operative surgery of the ear.

An outfit consisting of electric motors with an arm-piece and burs, jewelers' saws, etc., should be at the disposal of the students, who should be encouraged, under competent instructors, to make specimens showing the relationship of the anatomical structures involved in operations on the ear. Exhibition of specimens should be made by graduate students with this object in view.

Specimens to be handled by students while doing cadaver operating should be of such a character as not to be readily injured by rough handling or contact with dirt. They are supposed to be handed over while students are at work, and hence are occasionally

dropped on the floor and otherwise maltreated. A single specimen should not show too many details but simply the anatomical relation of the parts under discussion. Most of the specimens for teaching should be made not from detached temporal bones but from heads from which the calvarium and brain have been removed, and may be wet, or in most instances dried preparations and macerated skulls.

Exhibition of specimens to illustrate the cadaver course in operative surgery of the ear at the graduate school of the University of Pennsylvania.

MARCH 15

Some Phases of Septal Surgery

BY JAMES A. BABBITT, M.D.

Overcoming the barriers to progress in otolaryngology rather resembles the disentangling of a knot—one opens out a loop here and there and then halts to proceed in another direction. It is perhaps some years now since marked progress has been made in the field of septal surgery beyond the points obtained by Killian, Freer, Ballenger, Mosher and others; but during this time the fields of tonsillar technic, focal infection, direct laryngoscopy, pituitary study, and even with renewed attack the problems of the middle ear have absorbed attention. It therefore may not be amiss to bring up for discussion again, in the light of continued experience, some phases of the submucous correction of the septum.

It is perhaps safe to assume that in this day septal surgery is almost synonymous with submucous technic. To discuss the general procedure in submucous operation would be unworthy the members of this Section. It is simply my purpose to rather fearlessly present two or three phases for discussion which have seemed of special significance. These might be designated as (1) operative indication; (2) operative election, and (3) physiologic reaction.

1. Operative Indication. There can be but one fundamental purpose in view, that of maintaining or restoring, when lost, the normal physiology of the nose, and we are here interested only in so far as the septal anatomy or the anatomic pathology is concerned. This, furthermore, is only concerned in its contribution for or against bilaterally equal ventilation, for this is primary in its consequence to nasal health. Other nasal disturbances—catarrhal discharge, vitiated olfaction, sinus congestion, etc.—are secondary not in consequence but in order of procedure. The discovery, however, of septal abnormality proceeds from secondary or distal factors—the evidence of pharyngeal infection and obstruction; the search for cause of deafness; exacerbations of sinus congestion, and only infrequently upon the occasion of routine prophylactic examination.

The eye calls for attention by immediate symptomatology of ocular symptoms; the teeth are being given almost inordinate attention in these latter days; but unfortunately the nose is only discovered when its secondary consequence has arrived, and that more often a well-advanced tubal disturbance. This point might deserve special emphasis.

The septal factor is not usually recognized until its secondary effects are fully organized, and its surgical treatment, be it ever so clever, is not entirely retroactive in result.

The first impulse of the rhinologist upon the discovery of deflection, spurs, ridges (anterior and posterior) and osteomata is to clear these up by complete resection if the patient is submissive. The assertion may be made that, other things being equal, only good can result from such procedure; but its effect is in large as preventive of further encroachment of nasal disease, and much discussion has arisen as to the ruthless and unnecessary surgery of the septum to relieve nonsuppurative otitis media of chronic type and the almost inevitable failure to relieve tinnitus and deafness.

Beck, in describing his operation, submucous resection, has given the indications as "nasal obstruction to breathing, ventilation of the sinuses and *middle ear* and to correct certain nasal deformities." This at once raises the question as to just how far nasal obstruction is contributory to otitis media and of how much real value the

time-worn phrase "rarefaction in the fossa of Rosenmüller" is tenable. Experimental study of negative and positive intranasal pressure has been reported by Mink, Goodale, Spicer and Durkee, the latter having investigated a series of cases with manometer tracings on a revolving drum. He found that negative air-pressure in the nose and nasopharynx during inspiration, with the mouth closed or open, or during the act of swallowing, was not a cause of ear disease, the negative and positive pressures during inspiration nearly balancing even with an obstructed condition; and, conversely, that the determining of nasal air-pressure was of no great value in diagnosing the degree of nasal obstruction. Equally important studies were made, in 1915, by the New York State Commission on Ventilation, which by the use of the improved Glatsel mirror experimentally determined from the deposit areas of moisture the effect of atmospheric conditions, temperature, humidity and air movement upon the upper respiratory tract—the majority of changes being in increased swelling, moisture and redness, and with the resultant conclusion that the theory of bacterial infection as the sole cause of catarrhal inflammation was untenable. Both of these factors have an important bearing upon the contribution of nasal obstruction to tubal disturbance. It is evident, however, that the first effect of an obstructed passage is to produce congestion and chronic hyperplasia; the second effect to lock off sinus drainage and produce rarefaction of oxygen in the sinuses and consequent attenuation of the membrane, if not acute infection. The next effect, in all probability, is to continue this hypertrophy and infection into the tube, as may be demonstrated by the routine use of the nasopharyngoscope. Cause and effect seem logical, but a well-defined adhesive type of otitis media will probably be little changed by any septal surgery—in fact, often not affording the apparent amount of relief by careful routine per tube and aural canal, especially if this be accompanied by a painstaking research into and reorganization of the patient's cardiovascular and nutritional apparatus.

But are those who condemn septal procedure unwilling to admit that a nares, made healthy in its physiology, will not contribute most in fortification against further advance in disease, and, also,

that this procedure in careful hands, while a most skilful operative one, is remarkably free from serious shock or other danger to the tissues?

It was not the intention here to cover the field of submucous surgery or conduct its defence, but rather, through the foregoing prelude, introduce a special phase of the subject for discussion. Most of our submucous or other septal operations have been done on adults—often on patients we have been watching from childhood, fearful of disturbing external contour from too early interference. But little has been reported on distinctly juvenile septal surgery, although Rosenheim reported successful work in several cases from ten to fifteen years of age. By the time this is usually done, however, as suggested above, fixed changes have occurred and treatment will be only partially remedial; and in honesty prognosis should be given as a chiefly preventive one. If such correction is indicated, should it not be obtained early enough in life to antedate sinus and auditory change? The citizen of today has been rapidly educated to a new view of child hygiene. The creation of the draft examinations have shown the overwhelming importance of establishing early examination and laying the adequate foundation of physical training during the formative period between five to twelve years of age. Quite likely this is in large measure due to the active propaganda of pediatricians, whose function seems to be increasingly that of preventive oversight of the child during its earlier years. The initial function of the special sinuses, all so dependent on the nasopharynx, is surely almost as important as the care of nutrition and the respiratory, cardiac or neural apparatus.

If such were possible the logical procedure would be to determine the causes for septal distortion and eliminate the factors involved. Most of this belongs in the field of odontology. Freeman has stated that 290 out of 302 cases (96 per cent) of septal obstructions were found to have high arched palates, and incisor eruption as well as imperfect molar adaptation (the former through development of the premaxillary bones and the latter from relation to the horizontal portion of palate bones) are factors in the upward push, bending the soft septum against an unyielding cranial base. Much has been written on this question of obstruction etiology.

Ballenger reviews the views of Loewy on Rachitis; Trendelenburg on Lack of Development of the Maxillary Bones; Morgagni on the Excessive Development of the Vomer; Bosworth on Traumatism; Talbot on Unequal Development of Adjacent Bones, Especially Turbinate and Facial.

Mosher, in his masterly research presented before the American Laryngological, Rhinological and Otological Society in 1907, while making a proper plea for traumatic share and reviewing the prior work of Sieur and Jacob, clearly demonstrates the part played by asymmetry due to inequality of growth in the hard palate, superior maxilla, palate bones and premaxillary bones. It does not seem, however, that, beyond the field of orthodontia, measures of relief have been very freely offered. Cases are constantly observed, under the age of twelve, where by tactful and repeated examination a clear diagnosis of abnormal septum may be obtained, often with well-marked degenerative changes in the turbinates; but the real difficulty is presented in demonstrating obstruction at an age when examination is difficult. Tonsils and adenoids may be successfully removed and still the chronic rhinitis will persist. Many ingenious devices will apparently give some aid in registering the breathing capacity of the two sides, but, as stated above, intranasal pressure cannot be accepted as diagnostic. The use of the mirror, powder films, pendulum wisps of cotton or feather, breathing into a chemical mixture and tambour registration to a vibrating needle have all been suggested and might be helpful, if repeated sufficiently, in demonstrating temporary congestion and if observed at home during sleep; but in the last analysis decision must be based upon actual examination. When such diagnosis is positive are we not justified, during this plastic age, in correcting the deformity which has dislodged the vomer from its socket or fractured its wings, producing the long horizontal ridge at the attachment of the vomer to the perpendicular plate and quadrilateral cartilage or deflecting the septum vertically at the junction of the vomer? Mosher has made the statement, and his authority is strong, that the septum is not fully ossified until the eighth year and the premaxillary wings do not fuse with the tip of the vomer until the fifteenth year.

It has been my opportunity to make a large number of routine nasal examinations in boys from six to eighteen years of age and the records show a very considerable percentage of vitiated position. In 67 cases recently reviewed, without reference to the later report, 22 per cent presented marked, 25 per cent moderate and 7 per cent slight septal obstruction; only 46 per cent were normal, and the subjects were of rather high type. This would seem to point inevitably to later involvement of sinus areas, if not surely inducing tubal sequence. The developmental factors in etiology may perhaps be avoided, but once established they are difficult to reverse. What solution, therefore, may be adopted? By fragmentary submucous work under careful illumination, scarcely actually removing any cartilage or bone, the abnormality may be corrected, perhaps wisely overcorrected, and at this early age it quickly reattaches in corrected position. It would not be difficult to correct such septums when removing adenoids not complicated by other disease conditions. The few cases in the writer's experience, perhaps twenty-five, while not observed over too long a period of time, have shown remarkably quick response to surgery involved, and it would seem worth while to carefully observe a considerable number in the clinics over several years' time.

In such adolescent correction another phase of the subject presents itself, namely, the correlation of external and internal deformity subsequent to traumatism. In fact, this applies to adult surgery with equal force. If the nose is displaced externally there is almost certainly compensatory interior deviation, and many submucous procedures while leaving a flexible membrane leave at the same time a most unsatisfactory hang in the septum with a passage in the area of the nasofrontal duct practically as narrow as prior to operation. In about 20 cases of external nasal correction the separation of the nasal process of the superior maxilla by the chisel was attended with little shock or trauma and the 5 mm. scar even in adults promptly disappears. Careful inspection and alignment down from the internal canthus demonstrate an external displacement perhaps but little previously noticed by the patient's family yet profoundly etiological in nasal inequality. Often the septum maintains proper

alignment after external correction alone, and in view of frequent failures without such procedure one would be more often justified in accepting this method and combining with it an upper or lower linear resection internally. In the younger children who accept traumatic injury so often and so graciously, and in whom replacement is more readily obtained, correlated deformity might be more often corrected.

2. Operative Election. Presented a nose with more or less distortion of the septum and perhaps defined involvement of turbinate areas on one or both sides, what procedure shall be adopted? Of fundamental importance would be a radiographic study of the nasal cavity and accessory sinuses with, if possible, a differentiation of exudate in the anterior and posterior ethmoidal cells.

The existence of septal deflection, ridge or spurs coincident with the generative changes in the turbinates does not necessarily prove which was the initial fault. A roentgen-ray plate is often necessary to determine whether the septum is actually out of place or such appearance is presented from hyperplasia of the septal membrane on one or both sides, and the personal equation is important, as the operator's special preference to and experience in sinus work or in septal work may, in a certain measure, magnify the importance of each. The infantile processes involved in the production of the deformity would seem, however, to emphasize the initial septal fault, and if the antra and the frontal sinuses are not involved and the exudate be limited to the anterior group of cells, should not the septum be first considered rather than lateral ethmoidal areas, even in the presence of an almost cystic inferior turbinate in opposite concavity and surface degeneration of middle turbinate structures? With a badly distorted septum trouble will continue even after the inferior half of the middle turbinate has been exsected or the hypertrophied turbinate incised or cauterized. We realize how often this procedure is not followed, and the question often arises when patients, still unrelieved symptomatically, present with picture and history of sinus exenteration, "Why was this septum not corrected?"

The counter objection will be presented that active infection in sinus areas will endanger the field of operation. This is entirely possible, yet one cannot but marvel at the natural immunity always present in nasal cavities which guards operative technic. The writer is under the impression that most rhinologists respect this natural provision for safety and hesitate to spray or wash out secretions to any extent prior to the submucous operation. The only answer to this objection is that such infection usually does not appear, although infective germs must always be present in greater or less degree.

It is logical to proceed along physiologic lines and to attack the spot before the branch. The question is presented for discussion as to whether or not suspected sinuses are not more often automatically relieved after orthopedic work upon the septum than the reverse. It is often surprising how much trouble will be produced by a simple synechia from the septum to the lateral surface of the nose.

3. Physiologic Reaction. This title as here applied refers to that physiologic reaction or shock in the patient under septal operation, an area so involved in special-sense correlation. It is not the purpose here to discuss the chemistry of nasal secretion or the histologic changes in the mucous membrane. Most excellent work has been done upon such lines, as, for example, the exhaustive study of the lymph drainage in the nasal cavity, accessory sinuses, etc., reported by Mullin, with further reference to the researches of Andre in France. In the valuable, frequent, and readily performed operation we are all concerned in minimizing the element of "knock" to the patient. Its frequency and popularity, as in the case of the appendix and the tonsils, minimizes the psychic side of autosuggestion; but one or two suggestions from experience may induce many in discussion. In other words, here is an operative procedure simple for the skilful operator. How can it be made even more simple? To one who has been working along this field it is a little difficult to recall how much of the procedure is even partially original and how much impressed in the observance of the skilful performance of others. Under this heading might be included the effect of

anesthesia, hemorrhage, meningeal safeguards and factors in simplifying the septal reconstruction.

First, as to the position of the patient, which recalls an early reference by Beck. Assuming that the rhinologist can coördinate himself to whatever is necessary and orient the line of the nasal bridge in any position, the prone position would seem the right one to ease nervous strain in the patient. His head rests instead of being held muscularly, blood naturally determines to trunk centers and syncope is less frequent. Unwonted movements are less frequent to disturb vision or the instruments of the operator. A slight elevation of the head-rest would aid this vision without changing the general plane.

Secondly, as to anesthesia: It has not been my fortune to succeed in nor have I witnessed the successful nasal bloc in infiltration anesthesia. Dental experience has proved its efficiency, and it ought to succeed in the nose. When all is said there still lingers an underlying distrust of the safety of cocain used in sufficient percentage strength to really make an absolutely painless procedure.

The operator frequently varies from one to the other method, influenced by some startling experience, although serious toxemia seems rare. It is important in cocain anesthesia to get a rapid surface effect and prevent a slow absorption. Many writers have urged the use of cocain powder rather than a solution of some special strength, but perhaps all have noted that peculiar reaction in the patient which sometimes occurs at the point of beginning numbness in the incisor area, sometimes with the first forcible passing through the bony plate of the ethmoid. The patient perspires, blanches and feels sick. Many operators disregard it but others give it the diagnosis of cocain toxemia. Possibly analogous in its effects only is the temporary pneumogastric halt noted at the time of actual separation of the tonsil under operation. The cautious operator will be provided with ammonia and stimulant ready in hypodermic for such emergency, which, of course, only occasionally comes. A fatality in this procedure, which is regarded as immune as in the biblical assurance on childbirth, would be startling and depressing enough. So why not train ourselves to

work a little more frequently in this field under our tried and true friend, ether anesthesia. As experience in 50 or more cases has proved that the procedure is not difficult, especially with the use of a delicate suction tube, and all results have been as satisfactory as in the slower procedure under a local anesthetic, and patients these days will readily accept ether. A thorough application of adrenalin prior to and not during the anesthesia period often affords a nearly dry field, and our movements in this operation, which so lends itself to precise technic, ought to be nearly automatic.

An experience of three serious nasal hemorrhages, occurring from eight to ten days subsequent to operation, both normal in vascularity, has left its impress. Careful preliminary tests of coagulation time, especially intravenous ones, indicate fibrin normality, but do not reveal the possible variance in action of the vessel wall. The amount of blood lost occurring from such a frankly visible and mucoid area is always exaggerated, but the mental strain to the patient is positive. Every devise possible—intranasal and post-nasal packing, oils, bismuth, peroxide, preparations of iron, tannin, etc.—afford an ample field for endeavor. One suggestion is offered: Too much effort at control may often aggravate rather than relieve the flow.

Thirdly, the danger to the cribriform plate and meningeal involvement from too high and too active disturbance of the bony plate will be admitted by all. This suggestion is offered to eliminate danger: By inserting flat-bladed cutting forceps of some type in the highest linear point of the vertical plate necessary for correction and easily removing a narrow segment clear back to the vanishing thinness of the posterior border, all the field below presents little danger and the remaining parts, even all the vomer ridge, can be quickly removed. Even the pool of blood in the contained walls does not seriously interfere, and a slight counterdrainage opposite to the working side will remove probabilities of hematoma or isolated mass of clot, which, of course, is prone to become infected in time and vitiate the otherwise successful result.

Fourthly, septal reconstruction will often be favored by controlling the desire to remove all bone and cartilage. Portions released from

the upper or lower attachment and not exerting pressure will be an advantage *in situ*. From some operator came this early suggestion: To make a bevelled entrance through the cartilage by a moderately sharp spatula, which readily slips along beneath the perichondrium of the opposite side, renders perforation less liable and minimizes the likelihood of linear elevation with crusting at the line of the incision.

In closing the discussion, added emphasis may be laid upon the value of minimizing postoperative interference in this field of special surgery. Long-continued after-treatment can be avoided by skilful procedure.

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A New Instrument for the Insertion of Radium Needles into the Tongue, Pharynx and Larynx

Dr. George Fetterolf presented a new instrument for the introduction of threaded radium needles into the tongue, pharynx, and upper larynx. The instrument is essentially a tube and plunger and is so constructed that half of the needle projects from the end while the thread is carried back to the operator's hand in a narrow,

shallow gutter which lies lateral to the tube. With the use of a head mirror and a laryngeal mirror the needle is pushed into the tissues for half of its length by direct pressure, and is then buried for the remainder of its length by closing a handle held by the operator. This closing of the handle drives the plunger against the eye end of the needle and forces it out of the carrying tube, burying it in the tissue to the full length of the needle. After the needle has been fully inserted the thread is released from its carrying groove, the instrument withdrawn from the mouth, and the thread brought out of the angle of the mouth and fastened to the cheek with plaster in the usual fashion.

The only new part of the instrument is that which carries and introduces the needle. The handle is the well-known "universal handle," which is used for many different types of laryngeal instruments.

The Use of Endocrines in Diseases of the Nose and Throat

BY S. M. WILSON, M.D.

The subject to which I invite your attention this evening lies in the border-land between otolaryngology and general medicine. A certain amount of general treatment is frequently necessary to assist in reducing intumescence, to cause absorption of exudates and after operations to favor healing with a minimum of scar tissue.

Some of the so-called endocrines appear to help in this manner. The success of operations or other measures which we have adopted may depend on the action of these remedies, and personal supervision is necessary for their success.

In neurotic cases we realize that the nasal intumescence, rhinorrhea and asthmatic seizures are merely a very annoying and conspicuous part of a general vicious circle in which the erectile tissue of all parts of the body is involved. Skilful treatment of

the nasopharynx will give great and prompt relief and distant symptoms having no apparent connection with the nasopharynx improve coincidentally. Local treatment relieves intumescence. Pressure will require resection of turbinates or septum. The lack of vascular tone, however, previously manifested in so many ways, is improved to only a slight degree and prevents a complete cure. No matter how thorough the local treatment the condition seems to recur. The subjective symptoms continue and the endocrine treatment is necessary to relieve these.

When intumescence is present, pituitary extract representing from one-third to one-half grain of the gland, combined with an equal amount of the chloride of sodium, is an average commencing dose for an adult. It materially helps to relieve the sinus conditions secondary to engorged turbinates and the sleeplessness, headaches and mouth-breathing induced by them. The administration must be continued for a considerable time. Similarly a hypodermic injection of 6 to 8 minims of pituitrin and 1 or 2 minims of adrenalin will frequently relieve extreme hoarseness when due to this condition and will maintain the effect for about twenty-four hours or more.

Only after a thorough shrinking with cocain can we determine whether an obstacle exists which will require surgical removal, treatment by other means being a mere waste of time, for it is evident that although the glandular treatment is mentioned as effecting curative changes in several conditions it is only an adjuvant to the measures commonly used when the glands are omitted. Hypodermic injection is better than administration by the mouth, two or three in the week being sufficient in most cases. The subject is such a prolific one for debate and for the expression of contradictory opinions among those who have made a scientific study of it that an attempt to explain the underlying principles seems useless, but an important action appears to be their aid in supplying a deficiency of one or more of the salts of the mineral earths. Calcium is commonly mentioned in this connection, but it quite frequently seems that magnesium, potassium or sodium is the one required. Probably an ioniza-

tion takes place, for only a small quantity is required to cause improvement. After such an operation as a sinus exenteration healing may be slow and accompanied by excessive scar tissue. In this thyroid is worth trial, at first in a small dose, such as one-quarter of a grain of the gland. If well borne the dose is increased. In streptococcic pharyngitis and in the enlarged cervical glands that accompany some infections of the nasopharynx and sinuses lymph gland in 5-grain doses has a satisfactory effect. Like thyroid, with which it may be beneficially combined, it will in susceptible individuals induce symptoms of thyroid intolerance, necessitating its temporary withdrawal. When prescribing this treatment for adenitis it is advisable to withdraw it temporarily as soon as any diminution in the size of the swellings is noted and to substitute cod-liver oil. After a few days, if resolution is not proceeding too rapidly, the thyroid and lymph gland may be resumed, the oil being continued. Treatment with lymph gland will usually cause a reduction of simple thyroid enlargement, as does treatment with thyroid gland, and as announced by Hugh Ashby in 1913, will reduce to normal most cases of chronic enlargement of adenoids and tonsils, with a corresponding improvement in the health of the patient. It has been suggested that hypertrophy of the tonsils and adenoids is not usually a primary pathological condition but the effort of the system to combat such a one. Whether or not this is entirely correct, there is reason to believe that treatment of the nasopharynx will usually lead to improvement.

Pituitary given intravenously with a small dose of adrenal is probably the most prompt, reliable and powerful stimulant of the heart and circulation at our command. It acts well in surgical shock and in influenza. The effect of a single dose may be maintained for as much as thirty-six hours.

Instead of being contraindicated in hemorrhage it is very useful in that condition, especially if the bleeding comes from an oozing surface, as during tonsillectomy or a nasal operation. Potent for good an overdose may cause alarming symptoms, prominent among which is air hunger. Anyone undertaking

its administration should know this and that the symptom will subside if the patient remains recumbent and quiet. In an elderly person it is a wise precaution to give only half the dose intravenously for a prompt effect and a few minutes later give the rest subcutaneously, a preparation containing adrenal being absorbed rather slowly from the subcutaneous tissue. A peculiar phenomenon, seen not infrequently in asthmatic patients, is the great and prompt relief that may follow a dose of adrenalin and be maintained for twenty-four hours or more, and then in the same subject on another and apparently similar occasion not only no relief follows but the condition be aggravated.

In a case in which hemorrhage is anticipated, for instance after a turbinectomy, in which subsequent packing is not intended or where a history indicating a tendency to abnormal bleeding has been obtained, a preliminary injection of one of the hemostatic serums will greatly lessen or perhaps entirely avoid that outcome. The addition of 1 minim of adrenalin and 4 or 5 minims of pituitrin lessens the likelihood of the anaphylactic symptoms that sometimes follow the use of the serum. If hemorrhage has already begun the same remedy should be used intravenously. To one who has not used it in this manner the result is unbelievably swift. The class of patients in whom adenoid and tonsil affections are found contains a large proportion of these in whom the so-called status lymphaticus exists. Under anesthesia, no matter how skilfully induced and in some cases merely from the fright that thought of an impending operation induces, they at times come perilously near sudden death. Such accidents are not uncommon. Lowering the head will sometimes tide over the crisis, but our most potent remedy is an intravenous injection of 1 or 2 minims of adrenalin with 4 or 5 minims of pituitrin. The jugular vein is in easy reach, and even in the excitement inseparable from such an emergency could hardly be missed. If circulation has not absolutely ceased this procedure will restore it, and even when it has apparently stopped for half a minute or so it is stated that such an injection into the heart muscle will again induce contractions. Of this latter I have no personal knowledge.

Specimen of Supernumerary Tongue

BY SAMUEL COHEN, M.D.

This case is of interest because of its extreme rarity. I have been unable to find another case like it in the literature.

The patient, S. C., aged ten days, was brought to my office by Dr. A. with the following history:

Dr. A. delivered the child and soon after birth noticed a difficulty in breathing, especially on inspiration. A peculiar noise or gurgling sound was heard continually. The child was almost continually cyanotic. The breathing became easier on holding the head low down. After several attempts Dr. A. was able to notice a foreign body in the throat and then brought the child to my office.

Examination showed the following: Weighed seven pounds. Mouth open. Breathing noisy, floppy and gurgling. Retraction on the supersternal notch and spaces between the ribs. Examination of the throat showed a peculiar body lying in the pharynx, more toward the left, parallel to the long axis of the pharynx. Breathing caused it to move either up or down or to slip over the tongue, bringing itself into plain view. When lying on the tongue this body appeared the duplicate of the tongue, so much so that Dr. A. and myself both agreed that it was a case of double tongue. The child breathed almost normally as soon as this mass was grasped and held forward. On inserting my finger I found that the mass sprang from the left pharyngeal wall behind the left posterior tonsillar pillar on a level with the soft palate. By means of a snare this mass was removed as near as possible to its base. It was then sent to the pathologist of the Howard Hospital for examination and report, being very careful not to tell the pathologist that we thought it was another tongue. His report is attached hereto. The child is almost a year old now and is in perfect health.

The specimen is a moderately firm, elongated, pinkish-gray

mass measuring 3.5 by 1.2 by 1 cm. The tip and edges are rounded. The posterior end is contracted like a pedicle. The posterior surface is slightly rough and in its posterior third the midline is marked by a shallow groove. The anterior or inferior surface is more smooth than the upper surface and marked in the midline by a slightly elevated ridge.

Microscopically this mass consists of principally vertical, transverse and longitudinal striped muscle fibers running approximately at right angles to each other. This muscle tissue is surrounded by squamous epithelium resting on a tunica propria which is in turn supported by a submucosa of loose connective tissue. On the upper or posterior surface of the mass there are numerous mushroom-like elevations of the connective tissue covered with a thin layer of squamous epithelium (fungiform papillæ). In the deeper portions of the tunica propria and in a few instances down between the muscle bundles are a few tubo-alveolar glands lined with low cuboidal epithelium resting on a delicate basement membrane.

The specimen has the gross and microscopic appearance of a tongue.

Radiotherapy in Carcinoma of the Larynx, with Special Reference to Radium Needles Through the Thyrohyoid Membrane

BY GEORGE E. PFAHLER, M.D.

Radiotherapy in carcinoma of the larynx is not new. Individual cases have been recorded here and there through the literature, and some brilliant results have been obtained. Janeway, Barringer and Failla report in their book in 1917 on 27 cases of cancer of the larynx. Of these a clinically complete retrogression was obtained in 4, but 3 of these patients died later from a recurrence. One was still alive but was being treated for a small recurrence, which was yielding at the time of making the report. The applications of the radium were made by a capsule

introduced into the larynx and by the applications of radium plaques applied externally. They say that there can be no question that these results do not represent what should be accomplished in the treatment of cancer of the larynx by radium. It is a form of cancer which is usually discovered early enough to yield to radium as judged by the effects of radium on similar growths situated elsewhere. The great difficulty concerns the accuracy of application. The majority of these cases have been treated by the insertion of single radium tubes within the larynx, retaining them in place by the little barbed hook. A few of the earlier cases had been treated by the insertion of single tubes on the end of long wires which were held between the teeth, and a few cases had also been treated entirely by external application. More recently they have been using the 3 mm. platinum tube and making direct application of the radium to cancer in the larynx.

In intrinsic cancer of the larynx several of the 3 mm. tubes, enclosed end to end in a small-size rubber tube, may be passed into the larynx. If the position of the rubber tube is marked by a ligature the whole series can be withdrawn until this tube is just above the carcinomatous area, which will now be in contact with one or more radium tubes. They say that such a method is far more exact than with single tubes, which are difficult to place at the exact desired level on inserting into the larynx.

Having very nearly lost one case from edema of the larynx they very properly say that the greatest care should be exercised in attempting to treat a patient with carcinoma of the larynx without a preliminary tracheotomy. If the case is early it is possible to do so without danger, though even in such a patient the dose should be very carefully adjusted. If, however, the lesion surrounds a large part of the laryngeal cavity there will be an additional constriction of the laryngeal cavity produced by the swelling and edema following the treatment. A preliminary tracheotomy need not be done in the early cases. They state that this method of application is not applicable with advantage o cancer beginning in the pyriform sinus or cancer of the epiglottis.

In cancer of these locations it is wiser to insert individual tubes, making use of the barbed hooks to retain them in place. By this means in two cases of cancer of the epiglottis they have obtained a total clinical retrogression.

Barajas says that spreading epithelial tumors undergo a process of amelioration even to an apparent cure. The radium should be placed *in situ*, using the gamma rays and avoiding the stimulant action of the secondary rays. He says that not less than 45 to 60 mg. nor more than 75 to 80 mg. should be used. A maximum duration of two hours should be used at each session. These applications should be as frequent as the reaction of the organism after treatment will permit.

Cottenot reports a case of cure of a spindle-cell epithelioma of the larynx by roentgen ray in a man of fifty-eight who had a tumor of the larynx which was later shown by biopsy to have been a spindle-cell epithelioma. The tumor was so advanced that laryngectomy was advised, but roentgen-ray treatment was decided upon. To preclude edema a preliminary tracheotomy was done. From January 11 to 17 six roentgen-ray treatments were given on succeeding days. Penetrating rays were used, filtered through 8 mm. of aluminum. The total dosage for the six days was 44 H. There was no skin reaction nor was there edema of the larynx. A second series of irradiations was given from February 9 to 15, 44 H. being given in that time. There was quite an edema this time. February 22 there was no trace of tumor or infiltration. The patient was seen every week, and on March 15 extubation seemed justified, but as such a rapid and complete recovery was totally unexpected a final series of treatments of 15 H., from March 18 to 20, was given. April 5 the tube was removed and the larynx was apparently perfectly normal. The patient had gained 5 kg. in weight during the course of treatment.

Alexander reports the disappearance of a squamous-cell carcinoma of the larynx, under the influence of intrapharyngeal introduction of 50 mg. of radium sulphate, filtered through $\frac{2}{10}$ mm. of silver plus $\frac{5}{10}$ mm. of brass. Applications were made at

intervals of five weeks. In all ten times, twenty to forty-five minutes long at each application, after local anesthesia had been applied. The roentgen rays were applied externally.

Hickey has treated successfully a recurrent benign papilloma of the larynx by introducing a catheter through the tracheotomy wound from below and attaching radium by means of a string, which would hold the radium firmly in any position by control from the string above and one through the tracheotomy tube. He then applied the same treatment in a carcinoma of the larynx. The result of the treatment of the carcinoma of the larynx was not reported. This method of treatment, as suggested by Hickey, is, however, another method of making an application in an otherwise difficult position.

Radium will, of course, accomplish best results when it can be applied directly in the tumor tissue. With the exception of the method used by Hickey, however, it is difficult to introduce radium into the larynx and keep it in position for any length of time, especially in an advanced case.

In association with Dr. George B. Wood we have tried to introduce radium into the larynx by means of an intubation tube, but not with great success.

Direct Application of Radium into Carcinoma of the Larynx may be made by four different methods: (1) One may insert into the diseased tissue by direct laryngoscopy emanation "seeds" and allow them to remain in place until they are imbedded by fibrous tissue, coughed up or inhaled. If the carcinoma is ulcerated and friable such seeds may drop or be inhaled into the lung and produce local necrosis or abscess of the lung. They could probably only be introduced into the upper surface of the tumor. (2) Needles containing radium element can be introduced in a similar manner and, attached to a strong thread, can be presented from dropping into the lung; but when the diseased tissue is friable it is extremely difficult to make these needles retain their place and not return with the needle holder. (3) One can do a laryngotomy and apply the radium by emanation "seeds" or radium element needles inserted into the diseased tissue under direct

vision. (4) One may insert the radium element needles through the thyrohyoid membrane into the diseased tissue on either side or on both sides.

The Insertion of Radium Element Needles through the Thyrohyoid Membrane. Believing that the insertion of radium needles through the thyrohyoid membrane was possible, I first discussed it with Dr. Chevalier Jackson, who also believed it to be practical. I then did this on the cadaver in association with Dr. Robert Hunter. We found that the needles could be placed as desired, the chief requirement being a knowledge of the anatomy and of the location of the cancer.

The patient should have a tracheotomy done before attempting the introduction of the radium needles, because the edema and congestion resulting from the application of the radium might otherwise lead to strangulation or, at least, to a hasty and inconvenient tracheotomy. If there is not much stenosis the tracheotomy may be delayed until the preliminary roentgen-ray treatment has been given.

External radiation should be given, I believe, by means of the roentgen rays to partially devitalize the primary cancer cells and any metastatic lymph nodes which may be present. This will make the puncture of the neoplasm less dangerous. The preliminary radiation will require one or two weeks, and it may be an advantage to continue the external applications until the tumor tissue has decreased to a standstill. This latter procedure was followed in Cases 3 and 4. In about a week after the tracheotomy has been performed the patient is likely to be ready for the introduction of the radium needles. The radium needles should be thoroughly sterilized and attached to sterile thread or, better, to sterile copper ligature wire. The needles can be sterilized in pure carbolic acid followed by alcohol and sterile water, or they can be sterilized by being suspended in boiling water. The patient is given a general anesthetic. The skin is cleansed thoroughly by means of alcohol. I believe that iodin is contraindicated because of the likelihood of the production of a dermatitis when associated with radiation. If the disease involves only one side

of the larynx I believe the needles can be confined in the treatment to the affected side. If both sides of the larnyx are involved the needles can be inserted on both sides. On the side on which one proposes to insert the radium needles the larynx is crowded as far as possible toward the affected side. Granting that the disease extends downward along the affected side one then introduces the needles as nearly vertical as possible and as nearly confined to the central portion of the disease as is possible. Ten milligram needles can be inserted approximately 1 cm. apart and left in place four to six hours. This will cause considerable reaction and probably edema, but if the patient already has a tracheotomy tube in place there is comparatively little discomfort. If the disease has not completely disappeared at the end of six weeks the treatment may be repeated as far as is necessary. Within two or three weeks after the introduction of these radium needles if there are any metastatic lymph nodes present the radium needles may be introduced into the lymph nodes and roentgen-ray treatment can be applied over the general area of the neck involved.

CASE REPORTS

Case I.—P. McL., male, aged fifty-six years, was referred to me on May 10, 1920, by Dr. P. F. Moylan for treatment of an ulcerated carcinoma of the larynx with metastasis, noticed October, 1918, or two years and seven months before being referred to me for treatment. He had been treated for five months by Dr. Moylan by local applications, and during six months he had had an enlarged lymph node, which the patient noticed himself, on the right side of the neck on a level with the larynx. Smears made from the throat and examined by Dr. Kolmer for tubercular bacilli were negative. A Wassermann test was also negative. His condition was getting rapidly worse, and at the time he was referred for treatment he was not able to eat anything excepting soft food and soup. Phonation was painful. He suffered from dysphagia. He had a hoarse, persistent cough. He had lost

thirty pounds. His appetite was poor. The entire upper portion of the larynx was filled by an ulcerating carcinoma which had destroyed about half of the epiglottis. The lymph nodes on the right side of the neck measured 4 x 3 x 3 cm. The patient was emaciated and cachectic. Roentgen-ray examination showed enlarged upper mediastinal glands the nature of which could not be determined.

A preliminary course of roentgen-ray treatment was given through twenty-one portals of entry, covering the entire neck from every angle as well as the upper portion of the chest, introducing the radiation from all directions toward the upper mediastinum. All of this roentgen-ray treatment was given during a period of five days. The patient then had a tracheotomy performed by Dr. Thomas J. Byrne.

One week after the tracheotomy was done and two weeks after the beginning of roentgen-ray treatment the patient was given nitrous oxide gas through the tracheotomy tube. Before any radium needles were introduced the patient coughed much pus from the tracheotomy tube, which indicated that the purulent material from the upper portion of the larynx had extended downward into the lungs. Under gas anesthesia eight radium platinum needles, each containing 12½ mg. of radium element, were introduced obliquely downward through the thyrohyoid membrane on the right side and left in place for four hours. Then two were introduced anteriorly upward, one on the left side upward and five others obliquely downward into the larynx on the left side and allowed to remain in place four hours. Then four needles were introduced into the metastatic lymph glands on the right side of the larynx and left in place for ten hours. At the end of this time the patient was in fairly good condition.

June 21, 1920, or approximately four weeks after the introduction of the radium needles, Dr. Byrne made the following report: "Cancerous growth anteriorly and laterally has almost entirely disappeared. No area of erosion whatever. Posteriorly we have some vertical points sticking directly upward, the sole remains of the cancer invasion. The nodule on the right side of the neck

has been reduced to about half." This report was made to Dr. Moylan. Dr. Byrne reported that also, at a previous examination, the whole latter portions of the larynx were involved by an intrinsic cancer. To this was added a very great destruction of the epiglottis, more marked centrally and along the free border. This morning I had my curiosity satisfied by a second examination of the larynx. At the preliminary examination a view of the cords was impossible. Today it was comparatively easy to see them during tranquil breathing and phonation, which revealed that the left cord was in its rightly fixed position.

The patient had no further treatment after May 24, 1920, at which time the radium needles had been introduced. July 14, Dr. Byrne reports: "An examination of his larynx reveals further progress in the destruction of his malignant condition. The remains of the growth described in a previous report show the elevation with a smaller base, that, of course, makes them relatively sharper in appearance. The sharp process is over the left arytenoid, is of a bluish tint and it would seem that the ultimate effect of your recent radium treatment has not reduced this particular focus of the disease. There is less disease present in the larynx than was present at a previous examination, and there is no evidence of ulceration." During August the patient regained his general good health and seemed in every way to be well, but on August 15 he died suddenly from heat prostration, according to the opinion of Dr. P. F. Moylan.

Remarks. This was the first patient in whom I tried to introduce the radium needles directly into the diseased tissue through the thyrohyoid membrane. The carcinoma itself was so badly ulcerated that it would have been utterly impossible to introduce and keep in place the radium needles by direct laryngotomy. The tissues were too friable, the ulceration was too great and the infection probably would have been carried into the lung tissue to a greater extent than was already there, as indicated by the purulent expectoration. Part of the epiglottis had been destroyed. A more severe test of the method could probably not have been chosen because we began with an emaciated, cachectic patient,

with infected lungs and local ulceration with metastasis. In spite of these difficulties he apparently recovered. His sudden death by heat prostration must be regarded almost as an accident.

Case II.—H. S., male, aged sixty-six years, referred on August 10, 1920, by Dr. W. D. Allebach and Dr. Spencer Kauffman. Eight months previously he had noticed difficulty in swallowing and slight deafness. During the preceding two weeks both symptoms became much exaggerated. He had lost thirty-three pounds in weight within six months. He had a large mass about 5 cm. in diameter, filling the pharynx and apparently projecting from the larynx. Dr. Kauffman had made the diagnosis of epithelioma of the epiglottis.

Preliminary roentgen-ray treatment was given externally and surface applications of radium were made to the tumor in the larynx. August 17, 1920, or one week after beginning treatment, 100 mg. of radium element, in eight needles, were introduced into the diseased area through both sides of the neck and left in place for seven hours. This seemed to produce a marked congestion and strangulation developed. An emergency tracheotomy was done by Dr. George Coates. Following this application of radium the tumor rapidly decreased in size and at the end of two months all evidence of the tumor had disappeared. The tracheotomy tube was then removed. Another course of roentgen-ray treatment, however, was given on either side of the neck.

The following radium treatment was given in all: August 17, 100 mg. of radium in needles inserted into the tissues of the neck at the top of the larynx. August 31, 1920, 100 mg. inserted into the base of the tongue. September 10, 1920, 50 mg. in 1 mm. of gold and 1 mm. of rubber were applied for two hours at the base of the tongue and repeated again September 17 and 20. September 30, 1920, 120 mg. of radium in the form of needles were inserted about the base of the tongue, in the left submaxillary region and in the right submaxillary region. May 24, 1921, there was some thickening of the tissues, over an area about 1 cm. in diameter, beneath the left angle of the jaw. We were uncertain as to

whether it was part of the original disease or fibrous tissue, secondary to radiation. We therefore inserted 40 mg. of radium in four needles directly into this thickened area. There has been nothing to suggest disease since that time. The patient is therefore alive and well, almost two years after this extensive disease from which he had good reason to die.

Case III.—George E., male, aged forty-eight years, was referred for treatment June 20, 1921, by Dr. M. S. Ersner. About nine years before this date he began to have hoarseness. In 1919 he developed influenza and then began to have pains in the head, ringing in the ears and pains in the chest, with loss of weight, and for the past year was not able to talk above a whisper. He had an attack of smothering sensation, and two weeks before he was referred for radiation treatment, on account of danger of asphyxiation, a tracheotomy was performed by Dr. Ersner.

Dr. Ersner sent with the patient the following description: "Pedunculated mass as large as a walnut is attached to the right vocal cord. The right vocal cord shows great thickening, together with thickening of the ventricular band and associated with a great deal of destruction. There is only slight destruction on the left side of the larynx."

Using a 5-inch spark gap and 5 ma. current with 6 mm. of aluminum filter and 40 cm. distance we gave a twenty-five minute exposure daily for four days, alternating from right to left side, so that within a week he received two of these doses, one on each side of the neck. The treatment was begun June 21, 1921, and he was treated June 21, 22, 23 and 24. A second course of treatment at 30 cm. distance, with twenty minutes' exposure, was given July 14, 16, 18 and 19. A third course of treatment was given August 2, 16, 17 and 22.

He showed immediate improvement from beginning of treatment, and on August 2 was discharged from the hospital. His voice had increased from a whisper to normal tone. The growth at this time had diminished 60 per cent, according to the estimate of Dr. Ersner. He had gained ten pounds in weight. He was

active, alert and looked like a new man. His voice was strong and color healthy. Dr. Ersner regarded the result as miraculous. The tracheotomy tube had been removed and the wound completely healed.

September 20, 1921, Dr. Ersner reported as follows: "Patient has infiltration on the right side of the larynx the size of a peanut, involving the ventricular band and cord. He has sufficient breathing space and most likely can stand radium with strangulation." Dr. Ersner suggested, however, that he should be kept in the house while he was being treated with radium, so that we could insert the tube if we deemed it necessary October 3, 1921, before the Pennsylvania State Medical Society, five 10 mg. radium needles were introduced into the tumor through the right thyrohyoid membrane. They remained in place eight hours.

October 20, 1921, Dr. Ersner reported that the tumor mass had decreased 100 per cent since his previous examination, which was before the radium treatment. Both his cords were now distinctly visible.

October 18, 1921, he was demonstrated before the American College of Surgeons, at which time there was no evidence of disease. January 16, 1922, he had slight hoarseness, but felt well and looked well.

Remarks. This patient was suffering from advanced carcinoma, required a tracheotomy to prevent him from strangulation, and under roentgen-ray treatment the tumor nearly disappeared, but finally reached a standstill, and further progress was not made until radium needles were imbedded into the tumor mass through the thyrohyoid membrane. This, seemingly, has removed the remainder of the disease. He is still kept under observation.

Case IV.—C. N., male, aged fifty-eight years, referred by Dr. George B. Wood, January 23, 1922, for treatment of carcinoma of the larynx by radiation. The patient gave the history of discomfort upon swallowing two months before being referred to our department. This symptom gradually increased until, upon his admission, Dr. Wood found an infiltrating mass in the right

base of the epiglottis, malignant in appearance, involving the arytenoepiglottidean fold and right arytenoid body extending into the pyriform fossa and probably involving the epiglottis wall of the left arytenoid. Dr. Wood could not see the extent of the growth into the larynx.

A tracheotomy was performed by Dr. Wood, January 19, 1922. Roentgen-ray treatment was begun January 25, 1922, at which time, with a nine-inch spark and 5 ma. of current, at a distance of 40 cm., fifty minutes' exposure was given through 6 mm. of filter on the right side of the neck. A similar dose was given on the left side of the neck January 30, 1922. The right side of the neck was again treated February 12 and 21 with a twenty-five minutes' exposure at each time. The left side of the neck was treated January 30, February 10 and February 14 with twenty-five minutes' exposure. This treatment produced marked congestion of the larynx and trachea and slight edema of the left arytenoid cartilage, as reported by Dr. Woods February 14, 1922. There was still at this date a small infiltrating swelling, approximately the size of a large pea, at the right base of the epiglottis. Without further treatment, on March 7, 1922, Dr. Wood reported that there was still malignant disease on the posterior wall of the larynx, but that the tumor which had interfered with inspection of the larynx at the top had practically disappeared. The lymph node which was present at the right angle of the jaw, and approximately 1 cm. in diameter, had now disappeared. Radium needles are to be inserted later.

March 14, 1921, Dr. Wood can see no disease involving the larynx, and the disease, which involved the esophagus, is much reduced. He advises more treatment. Treatment had been interrupted because of edema of the arytenoids.

The preceding four cases are the only ones to which I have had the opportunity of applying radium by inserting needles through the thyrohyoid membrane. It is new work, but the results obtained so far seems to me to justify the use of this method

in other suitable cases. The next three cases to be recorded were treated by the roentgen rays alone by external surface application:

Case V.—W. B. F., male, aged sixty-nine years, was referred for roentgen-ray treatment on May 20, 1914, by Dr. William H. Teller and Dr. Arthur W. Watson, for treatment of a growth in the larynx just beneath the left vocal cord. Dr. Watson regarded this as an adenocarcinoma. The patient had been troubled with his throat for three months and complained of pain, uncomfortable sensation, some difficulty in swallowing and at times an interference with his voice, so much so as to make it difficult for him to make himself plainly heard. May 21, 1914, he was given thirteen erythema doses through 4 mm. of filter, and directed through thirteen different portals of entry, cross-firing as much as possible upon the larynx. May 22, he was given twelve full doses through twelve additional portals of entry. June 10, 1914, Dr. Watson reported that this heavy treatment had set up considerable reaction with edema of the arytenoids. The edema was greatest on the right side. June 11, 1914, fourteen additional doses, similar to the previous ones, were given through the right side of the neck and on June 13, twelve doses were given through the left side of the neck. August 1, 1914, twenty-one treatments were given through twenty-one portals of entry, cross-firing as much as possible upon the larynx. This was his last treatment and was followed apparently by complete recovery. July 14, 1919, or five years later, Dr. Teller reported that the patient was entirely well.

Remarks. This patient was well at least five years after a diagnosis of adenocarcinoma of the larynx was made. Since he has recovered there has been some doubt in our minds as to whether this was carcinoma. Wassermann test was negative. Even if this was not carcinoma but a benign papilloma we can certainly feel gratified at the result that has been obtained, for it will be a great satisfaction to realize that a benign papilloma of the larynx can be controlled by radiation.

In this connection I may refer to two cases of laryngeal papillomata in children that were reported by Dr. Alfred Gray, before the American Rhinological and Laryngological Society, Richmond, Va., February 12 and 13, 1909.

In May, 1919, Dr. Gray made a report on three additional cases, and by correspondence he tells me that he has added two more cases in adults successfully treated by the roentgen rays. He says, "I feel fully justified in recommending that the roentgen rays be applied in all cases of simple papillomatous vegetations of the larynx, and I believe that benefit or complete cure may be confidently expected."

Case VI.—E. S., male, aged fifty-five years, was referred to me for treatment of carcinoma of the larynx, July 10, 1919, by Dr. J. Leslie Davis. During eight weeks the voice of this patient had gradually faded away and at the time of beginning treatment he could only speak slightly above a whisper. His general health had remained good. Wassermann test was negative. Dr. Davis found the left vocal cord fixed with a tumor protruding between the true and false vocal cords. The right cord was freely movable and worked normally. Wassermann test was negative and all possible pressure upon the left recurrent laryngeal nerve was eliminated by roentgen-ray examination. During July 10, 21, 14 and 16 this patient was given twelve erythema doses of roentgen rays through twelve different portals of entry, cross-firing, as much as possible, upon the larynx. August 7, 8, 9 and 11 this treatment was repeated. August 7, 1919, Dr. Davis reports as follows: "Gratified to find voice more clear and general condition greatly improved. The local condition of the larynx shows a complete change for the better. The tumor is still visible, very slightly protruding, with puffiness of the left ventricle of the larynx, but the left vocal cord shows at least a slight excursory movement on phonation."

The patient was given a third series of twelve doses, cross-firing upon the larynx September 11, 12 and 13. October 3, 1919,

he was examined by Dr. Davis and found to be practically well. No further treatment was given. February 25, 1922, the patient writes: "I am feeling very good and have had no other treatment for my larynx since last you treated me. I have gone back to my normal weight, 160 pounds. I weighed about 130 pounds at the time of treatment."

Case VII.—H. G., male, aged forty-eight years, was referred for treatment of carcinoma of the larynx, March 14, 1917, by Dr. Menah. He had had throat trouble for one year. First complained of hoarseness, and this hoarseness grew progressively worse. He did not consult a physician until September, 1916. The throat was treated locally. For three days before roentgen-ray treatment the patient had marked dyspnea, which was so severe that he was unable to lie down at night.

Sputum examination by Dr. Warren Batroff was negative for tubercular bacillii. A Wassermann test made by Dr. Small resulted in a pronounced negative reaction. Dr. Menah reported: "Lower portion of larynx is involved on both sides. There is infiltration of the mucous and submucous tissues. The vocal cords are swollen and contain vegetation-like growths, dirty gray in color. It is malignant without a doubt."

Roentgen-ray examination, made March 23, 1917, showed a mass which filled the larynx and projected below. March 28, 1917, ten portals of entry were outlined on the neck and four on the chest, and four doses were given directed through the larynx, each consisting of a 9-inch parallel spark gap, 50 ma. minutes, 8-inch distance, 6 mm. of aluminum. Within twenty-four hours dyspnea became so marked that the patient was threatened with suffocation by laryngeal obstruction. It was necessary for Dr. Menah to do an immediate tracheotomy at night in order to save the patient's life. April 2, 3 and 25 two additional doses were given through other portals of entry. Because of a misunderstanding the patient did not return for further treatment until June 16, 1917, or approximately two months later. At that

time he looked perfectly well and was working every day as a stationary engineer. His voice was still husky, but he could speak and make himself understood. June 16, 18, 19 and 20 a second series of thirteen doses was given, cross-firing upon the larynx. July 24, 25 and 26 a third series of twelve doses was given through twelve different portals of entry, and a fourth series was given August 29, 30 and 31, consisting of twelve doses.

October 10, 1917, the patient looked well. His voice was returning; the tracheotomy tube was closed with a plug and the malignant disease seemed to be under control. The patient was working daily. December 8, 1917, Dr. Menah reported from his laryngeal examination as follows: "The swelling on the vocal cord has diminished very much, so that it is possible to see the true cords. The arytenoids are not much swollen and move nearly normally. The vegetation on the true cord has disappeared."

He was given a fourth series in October, a fifth series in November 1917, and a sixth series in December, 1917. April 23 the patient returned after having been working at State College in a laundry, and looked well. He had some cough which he called a cold. His voice was hoarse but he could be distinctly understood.

Under date of April 23, 1918, Dr. Menah reported the patient's condition as follows: "Edema of the false vocal cords and interior of the larynx, also of the arytenoid. The epiglottis is in good shape. Two cords are now visible."

May 25, 1918, the patient reported with the tracheotomy tube removed; the wound closed and the patient was in good general condition. He still had a dry, brassy cough, and he still had some hoarseness. At that time Dr. Menah reported as follows: "The patient is in very good shape. The arytenoids are still somewhat enlarged. The true cords are still somewhat congested, but as far as malignancy goes I think you can make this the last treatment."

The patient remained in good health for another year and

continued his work. He did not report in the meantime for observation. He then returned with an extensive recurrent carcinoma, from which he died. However from a hopeless and strangulating condition, due to carcinoma of the larynx, he was given at least two years of life and a reasonable amount of comfort by the exposure to the roentgen rays alone.

Sixteen additional cases have been treated by the roentgen rays. All have showed some temporary improvement. Two showed temporary recovery, but all ultimately died of the disease. As a result of these observations I believe that we may draw the following conclusions:

1. Unless the patient is treated very early and before there are obstructive symptoms it is desirable to do a tracheotomy before beginning treatment.

2. The roentgen rays applied externally alone justify the hope even in advanced cases or temporary recovery, or at least partial relief of symptoms.

3. The insertion of radium needles through the thyrohyoid membrane into the diseased tissue is practical and the results so far obtained seem to justify further trial.

4. These patients should be kept under close observation for several years, for the results of this treatment, as well as that recorded by others, show a marked tendency to recurrence. Each case must be judged by itself and the treatment directed to the condition present.

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APRIL 19

Speech Defects: Etiology and Treatment

BY MISS HELEN M. PEPPARD
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(By Invitation)

"Deprive a man of his speech and we deprive him of one of the greatest weapons of his brain in his fight for success."

An individual possessed of a serious speech defect is virtually deprived of speech. From 4 per cent to 7 per cent of our school population suffer from defects in speech varying in degree.

Experience has taught that correction of speech defects is not a work for the physician or surgeon. It is the problem for the teacher and the psychologist. This is readily appreciated when we consider that speech is an acquired activity, and in like manner speech defects are acquired.

Truly we need a sound mind in a sound body, and the work of the physician and surgeon are purely coöperative. But the knife or the medicine will not remove the *habits* of speech.

Speech defects are eliminated through correct mental training. It necessitates a reëducation of the speech centers. In the cases of baby talk, lisping, lalling or any other defect in sound production, it is a matter of incorrect auditory or kinesthetic mental imagery. Correct images must be substituted before the defect can be eradicated. For instance, a child says "tandy" for candy. It is not the word that is incorrect, but the single element "c" that is at fault. Therefore, we should correct that particular element. When we have conquered the difficulty, then let us apply the correct sound to the word. The same is true in lisping. When the lisper uses the word "thithter" for "sister," we must develop the correct production of "s," not of the entire word, because he has no difficulty with the sounds in the word other than the "s."

With stammering and stuttering there is an unstable mental condition. The individual has no confidence in his ability to speak. He is controlled by the "compulsive idea" that he cannot speak at certain times. How often do we find the stammerer when unable in conversation to say a word such as "mother," pause and make the remark, "I cannot say the word 'mother.'" There is no better proof that it is not the inability to produce the word, but the "compulsive idea" that has destroyed the power of production at that particular moment. Stammerers need training in clear, definite thinking. The instant a word fails a stammerer his thought process becomes confused. While this confusion exists no definite speech stimuli can be transmitted. The same condition exists in the individual suffering from stage fright.

No human being exhibits 100 per cent perfect speech. We all hesitate, stammer, repeat and use synonyms just as the stammerer does, but the fear that grips the mind of the latter does not enter the mind of the normal speaking person. This element of fear can be destroyed by teaching correct speech production and convincing the stammerer, through the power of suggestion, that he can talk on all occasions. The suggestion used must be reasonable and educational. We must actually make the stammerer talk while he is controlled by the "compulsive idea" that he cannot talk.

This necessitates strength of personality on the part of the instructor. He must, by his power of suggestion, arouse the latent force that resides in every individual. We do not correct stammering. What we do is to develop the power within the individual to destroy that feat of speech that creates the "compulsive idea." In other words, he must conquer himself, and we give him the weapons with which to fight.

OCTOBER 18

The Singing Voice

BY MR. HENRI SCOTT

When first I was asked to read a paper here tonight, I declined because I did not care to disclose my anatomical ignorance before you learned gentleman of the medical profession. In fact, it was hardly fair to ask me to do such a thing, but my friend, Dr. Wood, insisted that a paper bristling with technical terms was not expected of me—merely that I should tell you what I know, or what comes to my attention, as a singer and a teacher of singing concerning the throat.

With this indulgence granted beforehand, I will endeavor to tell you some of my observations and personal experiences in the belief, as I have been given to understand, that you may find something which will prove of interest.

Before I go any further, let me say, with all sincerity, that I am deeply grateful for the benefits I have obtained at the hands of throat specialists from time to time. More than once through their skilful treatment I have been able to save the performance. In fact so important is the throat specialist in the life of a singer that when a young woman I know came from the South to New York recently to study, the first thing I gave her was the name and address of Dr. Clarence Rice, of that city, because I felt certain that the change of climate might affect her throat; and I was right, for she has already been to see him and was enthusiastic over the relief he gave her.

When I was in Italy, about ten years ago, I talked with a famous maestro about voices, and, much to my astonishment—coming from him—he informed me that the finest singing voices in the world today were in our own United States—especially the women's voices. And it does seem as though the American people were waking up to the fact that American voices are really worth while. I have no hesitancy in stating that we have in this country the best vocal instructors. Titta Ruffo once told me that the art of teaching singing in Italy is a lost one.

A few years ago, while singing with Walter Damrosch, that distinguished musician, by way of complimenting me, stated he had found so many beautiful voices in America that if he were twenty years younger he would organize an opera company made up entirely of American singers that would not only compete successfully but even outclass the one of foreigners appearing at the Metropolitan on Broadway. A glance at the increasing list of American singers in both the Chicago and Metropolitan companies gives ample ground for Mr. Damrosch's statement.

English-speaking people, especially Americans, are handicapped by the very language, although a great deal of the fault is due to the slovenly way in which we talk, finishing the words back in the throat. For instance, it is a very common thing to hear, when two people are in conversation, the question, "What did you say"? necessitating a repetition of the sentence which would not be required were enough care taken to enunciate clearly. Among the Latins one rarely hears this question, the language affording such a forward pronunciation.

Foreigners have often told me that it is much more difficult for them to understand the American's English than when it is spoken by the Englishman.

The most precious possession of a singer is a good ear, for it is the ear that must be the singer's infallible guide at all times. Perhaps I should use the term *a keen, sensitive ear*, for I really believe that a singer's ear should be, and even often is, keener than that of the average person. I know that, in my own case, my ear was always very sensitive; so much so that when a youth I could never shoot a gun because the explosion was a distinct shock to my ear-drum—not to my nerves.

Faulty singing is due to various causes, but the chief one by far, and the one that I feel best able to talk about, is the throaty voice. Throaty singing is caused by arching the tongue in the back of the mouth. This, naturally, squeezes the tone and prevents free emission, at the same time limiting the power and volume of the voice.

Faulty intonation, or defective pitch, is also caused, primarily,

by the same habit of arching the tongue in the back, causing a pressure against the Eustachian tube, whereby the ear functions falsely and the singer goes off the key.

Now the method of overcoming both of these faults might be said to have been covered by the statement made by the great French basso, Pol Plancon, who when asked what were the fundamental points in correct singing replied, "Ici, e la, a rien de tout la." In short, control the breath emission by the diaphragm; let the throat be loose, trying not to think of its function at all, and place the tone in the nose, using the bony structure as a sort of sounding board.

There has been a great deal of discussion among voice experts about the use of the diaphragm in singing. One man went so far as to write a book about singing in which he ridicules its use. Be that as it may, whether it is actual or only mental, I feel, at least, that I do use it, and so do scores of others.

Resonance, and still more resonance—that is the slogan, and at the same time the obsession of the singer. The satisfactory results in singing with concentrated resonance are complete. I have demonstrated to myself its practicability as well as its absolute necessity. If public speakers could only learn to use a more resonant, forward tone they would suffer less from fatigue and hoarseness, and, moreover, the voice would have a more ingratiating effect upon their hearers.

The method of producing the resonant tone is very simple, namely, the consonant "M" and the vowel "E," afterward slipping into the vowel "A" (illustrating).

I have seen singers going through a number of such peculiar exercises, in order to make the voice sound more resonant, that to the layman, they would be termed nothing short of "antics."

The nasal resonant tone should not be confused with the nasal tone; the latter is, of course, wrong and objectionable. This is the difference (illustrating).

I claim that, by means of this resonance, a singing voice can be developed that may at the beginning give very little promise.

I do not believe in bewildering pupils with too many instructions

as to what to do with the different parts of the throat, other than advising them to keep the tongue flat, like a spoon, between the teeth in the lower jaw and allow the soft palate to hang in space like a curtain in order that the air may pass out through the nose and mouth at the same time and with equal freedom. It is well, also, to take in the breath through the nostrils when singing as much as possible. Sometimes, in a musical phrase, it is necessary to take in what is called a "catch-breath"; then this must be taken through the mouth, as the nose will not permit the air to pass in quickly enough. Sims Reeves, the famous English tenor, claimed that he took in all his respirations, when singing, through the nose.

To allow the soft palate to rest against the back of the throat when singing produces a hollow, woody tone (illustrating).

It is a singular fact that a slight cold in the head intensifies a singer's resonance, and I recall being able, about five years ago, in Boston, to give what I consider the best oratorio performance of my career when thus affected.

The following may interest you: About two years ago a baritone came to study with me. I found his voice almost hopelessly throaty—no resonance whatever and no hope of obtaining any. However, the man was intelligent, patient and persistent, and our work finally began to have its effect, and he now sings very well indeed. But this is the astonishing part of it. In order to obtain relief from this throaty singing, he had been in the habit of going weekly to a chiropractor who manipulated his throat and gave him temporary relief. After a while he found it was not necessary for him to go to the chiropractor any more, as the latter informed him that I had done more for him in loosening up his throat in singing than he had been able to do with his manipulation.

There is a habit I should like to speak of that I acquired from Titta Ruffo—with whom I was associated considerably when he first came to this country—holding the nose thus (illustrating) and swallowing. This blows out the ear-drums and has the effect of intensifying the hearing, so that the resonance is felt with the maximum keenness. I do not, of course, recommend

this to pupils, as I have been informed that it is liable to produce abscess if done to excess.

Singers resort to different tricks at times. John McCormack made his debut in opera in this country at the Manhattan Opera House, New York, the same year I did, in 1909. I have often sung with him, and it was curious to see him place his hand behind his ear on the slightest pretext while singing to magnify (to himself) the volume of tone. Many singers do this in recording for the phonograph, because it serves the double purpose of hearing one's voice more clearly and minimizes the sound of the accompanying orchestra, which, otherwise, sounds so excessively loud in the small recording room as to be disconcerting.

Doubtless some of you are familiar with the open and closed tone. With your indulgence I will briefly illustrate it: In the female voice we do not use this term, but in its place use the terms "head tone," "medium," and "chest."

There is one more point, and then I am finished. This is the matter of the tonsils. Inasmuch as I am still in possession of mine, I cannot speak from experience, because they have never bothered me. But in cases where they do give the singer great trouble, I unhesitatingly advise their removal. I know of two cases where the singer was distinctly benefited thereby. Some singers who suffer from unhealthy tonsils will not have them removed because they fear to lose their voices entirely. This is a question you gentleman ought to solve for the singer. Is there any scientific reason that may be given why their removal should affect the voice? (Story of Caruso—Mascotte.) (Mefisto—Inferno.)

OCTOBER 18

The Speaking Voice

BY C. P. GRAYSON, M.D.

It remains for me to consider the voice from a very material point of view, to study it not as a possible ornament, but as one

of the essential tools with which the average man makes his living. He may miss them more or less if they are lost, but a man's progress and success are not dependent to any extent upon his special senses of smell and taste, or even a keen sense of touch; but when he is deprived of either his sight, his hearing or his voice he must struggle against a very heavy and serious handicap. I do not propose to discuss the relative importance of these three factors of our physical equipment, but may I call your attention to the fact that although, as far as they are concerned, we are all created equal, no *normal* child having the advantage of another in any of these three things, yet when childhood merges into youth the influence of environment stamps itself almost indelibly upon one of the three—the voice. So far as the sight and hearing are concerned, Nature plays no favorites. Their acuteness is practically unaffected; it is not at all dulled by shocking sights or inharmonious sounds, and therefore the lad or the girl of the underworld can see and hear just as well as their more fortunate contemporaries of the world of fashion; but the voice, unfortunately, is much more sensitive to bad influences, and with daily exposure to them almost inevitably suffers from them through unconscious imitation.

Now this is no more than a brief prelude, not to a plea of any kind, but to a bill of indictment, that I would issue against our educational system for paying so little attention to, or utterly neglecting in fact, even the elementary training of the voice. Its higher education for the purposes of song or its use on the stage in any capacity can be left to specialists—it is, in a sense, post-graduate work; but I would insist that no child with an inefficient voice should be permitted to reach youth and enter adult life and have nothing whatever done to improve it. Our boards of education, and even we of the profession of medicine, are not apt to look upon that child as a cripple; yet he is, and if no help is extended to him, he enters upon his fight for existence with a decided limp—not in his legs, but his throat. It has always seemed to me a puzzling inconsistency that we spend so much time and money in cultivating the mental powers of our younger gener-

ations, and in giving them a fairly adequate acquaintance with our language, and yet spend not an hour or a dollar in teaching them how to effectively give voice to the knowledge with which we provide them. And this is the more strange and distressing because in neglecting the voice we are overlooking an asset of very impressive value in many lines of activity. Whether it be in the vast field of business, in the enormous variety of industrial pursuits, in the more exacting paths of the professions, or in merely social intercourse, the material value of a good voice can scarcely be exaggerated. And when I say a good voice, I mean not so much one of agreeable quality as one that is, in the matter of articulation, above reproach. A melodious speaking voice is a very nice thing to have, but it will not get its owner very far if he fails to make himself easily understood. The pleasant impression made by the sound of his voice is very quickly forgotten if the listener has to concentrate all his attention in the effort to comprehend what the lovely voice is saying. It is, therefore, of the practical use of the voice, simply as a means of communication between individuals, that I have decided to speak to you this evening.

A very few words will cover the little I have to say about the mechanism of voice production in ordinary speech. We are all familiar with the action of the lateral cricoarytenoid and the transverse arytenoid muscles in approximating the vocal cords; but if the larynx and cords were provided with no other muscles than these, the cords could produce but one primary note. Of course, this one note might be modified in richness and resonance by the addition of overtones, and also in volume, but its pitch would be incapable of any change, and therefore song would be impossible and speech would be limited to an absolute monotone. It is only through the tensor action of the internal thyroarytenoids, incorporated within the cords themselves, and the cricothyroids, which stretch and steady them, that changes of pitch and all the glorious musical and emotional qualities of the voice become possible. It may not be inopportune to refer here to the so-called change of voice that occurs in boys at the age

of puberty. Until that age the boy's larynx is anatomically identical with that of the girl; it is of the feminine type, and it is for that reason that we hear boys singing in the church choirs with pure soprano or alto voices; but with the very beginning of pubescence, the boy's larynx displays a sudden developmental activity and within a few months perhaps acquires the masculine type. This involves an increase in the capacity of the larynx; it spreads both laterally and anteroposteriorly, the cords increase in length, breadth and thickness, and the voice loses the upper octave of its feminine compass and drops to a tenor, baritone or basso. During this period of increased nutrition and growth there is a moderate degree of laryngeal hyperemia which is to be regarded as physiological, and there has to be a radical readjustment of the adductor and delicate tensor muscles of the cords. Until this is completed and their normal action reëstablished the cords lose not so much their power of tonal attack as their ability to sustain the tone, and consequently we have that ludicrous crack or break in the voice that sounds as though the boy were trying to yodel.

With this arrival at maturity of the voice, what shall we say of its correct, its artistic use? There is one fundamental principle that should govern its use in either speech or song, and that is that its production, its emission, should not be interfered with by any voluntary action of the laryngeal, pharyngeal or palatal muscles. The more automatic, the more completely involuntary the muscle work, the smoother, the more velvety in quality the voice will be. If the child, for instance, is led to forget any intentional phonatory effort by fixing his attention instead upon the correct action of his tongue, his teeth and lips in molding the vibrating column of air into distinct words, the other muscles will take care of themselves. They should be permitted to, and if they are, the voice will be free from that throaty, squeezed, contracted quality which is indicative of muscular interference, which is extremely offensive to a cultivated and critical ear, and which is rapidly productive of vocal fatigue. Any suggestion of effort is disagreeable enough in the speaking voice, but if it is detectable in the singing voice, it is ruinous to its purity of tone.

If we laryngologists, men and women, are ever going to be sufficiently philanthropic or public-spirited to devise and promote some scheme for the reformation of what is so often scornfully spoken of as the "American voice," I am convinced that we must begin in the child, not with an initial effort to improve the resonance and color of his voice, but with the determination to teach him to speak, to articulate with precision and distinctness. If a child is allowed to grow up with the idea that the best way to make himself understood is by raising the pitch of his voice and increasing its volume, it will be only the matter of a few years before his voice will show the pernicious and more or less permanent effects of hard usage. The wear and tear of this sort of thing on the laryngeal muscles and the delicate epithelium of the cords is very great (the vocal nodule is one evidence of it), and aside from the actual injury thus inflicted, a loud and high-pitched voice is exceedingly disagreeable. I do not know how you feel about it, but as for myself, if I were choosing a secretary, for instance, I would much rather have a homely, freckle-faced girl with a squint and a pleasant, well-modulated voice, than a perfect queen of beauty with a voice like a rip-saw. Our eyes could quickly become accustomed to the homeliness of the one girl, but God forbid that our ears should ever become indifferent to the vocal crimes of the other!

And at this point we are confronted by a question to which I think there can be but one answer, Has the speaking voice any place in the field of economics? I have already told you how I feel about it, and I am glad of my belief that a great many other people feel almost as violently about it as I do. And if I am not mistaken in this, it follows that many a young man or woman, otherwise perfectly satisfactory, may fail of preferment in some business capacity because of an intolerable voice. Desirable as a voice of good quality may be, however, it is, I think, of almost secondary importance to distinctness of utterance. The one thing is desirable, yes, but the other should be held as absolutely essential. The enormous loss of valuable time that is due to faulty technic in speech is, of course, incalculable,

but perhaps we may get just a faint conception of it from one illustration—the telephone service. Is there a day that each of of us is not several times interrupted in our work or our leisure by having to tell a number of people that they have been given the wrong number? That is a waste of our time. The time of the person calling the number is wasted by having to repeat it, and then waiting for the proper connection to be made, and finally the operator's time is wasted by having first to listen to the serenade of complaints from the party of the first part and then to make the necessary change. The loss of time for each individual may be a small matter, but in the aggregate it becomes of decided consequence, and when one thinks of the millions of telephone users and of the tens of thousands of times that this utter waste of time occurs in the course of each twenty-four hours, it becomes evident that the total loss must be something appalling. And who, I ask, is to blame for it? I would not be surprised if a large majority of people who were asked this question would reply, "The fool operator." But I would not agree with them. I would say, on the contrary, that the fault lies nine times in ten on the person who asks for the number, and who asks for it in such a careless, slovenly and unintelligible way that the poor, badgered operator can only guess at what is wanted, and, being but human, like the rest of us, occasionally guesses wrong. If all this loss of time were translated into terms of money, would it require much additional argument to establish the place that the voice and its correct use occupy in the field of economics?

Now, what are we going to do about it, or, preferably, what *ought* we to do about it? Will you permit me to express my own opinion first, and then, if you choose, and as I am sure you can, suggest something a great deal better yourselves? There are several things that I think ought to be done, and done with as little delay as possible. In the first place there ought to be a practically universal and ungrudging admission on the part of our educational institutions that they have been deplorably negligent concerning even the elementary training of that faculty upon which human intercourse most largely depends—the faculty of speech. And coupled with such a confession, there should be

a vigorous determination to make amends for the lamentable results of their negligence. Now, here is where I deliberately not only lay myself open to criticism but invite it. Someone must suggest a program if only to have it shot to pieces, and I am offering you mine as a target. I would have the initial step taken by the boards of education controlling our public schools and by the trustees or the headmasters of our private schools. The very emphatic announcement should come from them that no young man or woman would be accepted as a teacher who could not speak English clearly and distinctly, who could not be heard and easily understood at some appropriate standardized distance, and I would not have this rule made elastic or to undergo the least modification because of a political pull or an attractive personality. I do not think this is asking too much of the would-be teacher. As to the child, I would have his vocal instruction begin with his very first day at school by having him told and made to understand that he would be marked just as rigidly for the vocal as for the mental excellence of his recitations. I would have the teacher correct him, should he speak with an unnecessary loudness or a scarcely audible softness or with a confusing rapidity, and if this care of the child's manner of speech is as exacting and unremitting as it should be, it cannot fail of its purpose.

Naturally, some children will acquire skill in speech more slowly than others, but that is to be expected, and in this connection I am venturing to make one other revolutionary suggestion—that the so-called foot of the class should be transferred to the top of the room immediately in front of the teacher's desk. It seems to me that this suggestion has at least the virtue of common-sense. We know that the backward child is usually the victim of some physical handicap that makes him slow of comprehension, defective in memory and perhaps dull of hearing. He is very often of what we commonly call the adenoid type. Does it not seem to you a curious as well as a serious blunder to send such a child to the very bottom of the room, twenty or more feet distant from the teacher's voice, and thus to emphasize his physical and mental shortcomings instead of having some practical and scientific consideration for them?

NOVEMBER 15

A Mixed Infection of the Larynx, Followed by the Loss of Both Arytenoid Cartilages

BY JAMES A. BABBITT, M.D.

On March 10, 1922, I was called in consultation to see a patient, Mr. J., who had developed a serious difficulty in speaking, and even some dyspnea, following a most major operative procedure in the abdomen. The abdominal condition was reported as malignant, requiring removal of a portion of the intestine—some of the malignant area was inoperable.

The patient had some indefinite previous laryngeal history. In recovering from the operation, at which time the stomach tube was used, the patient had excessive retching and vomiting, and, in order to control this, clutched the larynx with the fingers far back in the mouth, complicating the present situation. The patient was suffering from a complete aphonia and some dyspnea periodically, and the larynx presented a general picture of congestion, edema, mucopurulent secretion and a white slough, entirely filling the ventricular cavities and obscuring the view of the cords and arytenoids.

Careful examinations by cultures and smears only revealed a mixed infection, principally staphylococci. Wassermann test was negative and no T. B. were found. Under local treatment the condition gradually subsided, first the right then the left cord appearing into view, and finally the arytenoid area was visible. There was a gradual voice return, though the left cord appeared somewhat paralyzed. The general picture in breathing was mid-cadaveric position.

On March 28, some eighteen days after my first examination, the patient coughed out what appeared to be the left arytenoid cartilage, and in two or three days the right one followed. *X*-ray, fluoroscope and laboratory examinations confirmed the diag-

nosis. This was further proved by conference with a professor of anatomy and one of our leading laryngologists. One specimen I present for examination, the other was sectioned at the laboratory.

Two or three weeks following this the patient commenced to recover voice, and after some six weeks was able to produce a fair tone, without, however, much variation in pitch. In June the patient was placed in the care of a New York specialist, his larynx capable of moderate tone production, alteration in the arytenoid field, but no malignant evidence. A letter received from Mr. J., on November 9, reports a somewhat discouraging semi-whispered phonation. Final outcome is impossible to report at this time.

The Anatomy and Histology of the Ear Labyrinth

BY B. A. RANDALL, M.D.

At an early stage of the embryo the epiblast on each side of the head invaginates as pits, which become detached sacs, to develop and elaborate into the complex membranous labyrinth. About this forms the bony labyrinth, longer known and supposedly giving form to its contents, but really of mere secondary and protective function. Unlike the similar and coincidently formed lens sacs of the eye, the otic vesicle receives nerve filaments from the neurons of the spiral and Scarpa ganglia, which extend to limited areas of its cavities; and here are formed hair-cells of special sense, constituting the Corti organ of the cochlea, the otoliths, maculæ of the vestibular sacs, the utricle and saccule and the ampullar cristae of the semicircular canals, while neuraxial fibers pass to the brain, relayed in the nuclei of the brain-stem to form the centripetal paths, finding their cortical centers in the first temporal convolution, especially on the left side. Meanwhile the cartilaginous nodules around the second branchial cleft, are dedeveloping into the outstanding auricle of most vertebrates; and a new involution of epiblast forms the external auditory canal; the inner part of this branchial cleft forms the tubo-tympanum

and its later extensions of mastoid cells, while the mesoblastic tissue intervening, especially Meckel's cartilage, develops into the drumhead and ossicle- or ossicular chain. These outer structures of the external and the middle ear become physiologically the conducting apparatus of hearing: the cochlea becomes its percipient end organ and the vestibular and semicircular canal structures constitute the kinetic and static end organs of equilibration.

Most of the epiblastic cells of the involuted otic sac become mere indifferent flat epithelium—only those connected by nerve fibers with the brain evolve into peculiar forms, except that some in specially vascularized areas, like the stria vascularis of the cochlea, become cylindrical gland-cells for the secretion of the endolymph, the fluid filling the membranous labyrinth, while perilymph spaces develop as a water-bed around it.

PROCEEDINGS

OF THE

SECTION ON GENERAL MEDICINE

JANUARY 23

Arsphenamin Dermatitis and Other Cutaneous Reactions after Arsphenamin

BY JOSEPH V. KLAUDER, M.D.

Since the arsphenamin therapy of syphilis is now a universal procedure and since most of the deaths following arsphenamin are associated with a cutaneous manifestation, it becomes a matter of considerable importance that one practising arsphenamin therapy should be cognizant of the prodromal symptoms and later symptoms of untoward cutaneous reactions after arsphenamin.

Arsphenamin dermatitis is essentially an arsenical dermatitis. The cutaneous symptoms of arsenical poisoning are variable and consists notably of erythematous, papular, vesicular lesions, erythrodermia, pigmentation and hyperkeratosis. All but the last may appear after arsphenamin administration and forms a group of dermatoses called arsphenamin dermatitis.

There is not only a striking analogy between arsphenamin dermatitis and the cutaneous symptoms of arsenic poisoning, but there exists an analogy between other untoward reactions after arsphenamin and symptoms of chronic arsenic poisoning.

Reference is made to itching, paresthesia and gastrointestinal symptoms, lassitude, headache and loss of weight. These symptoms not uncommonly occur after prolonged use of arsphenamin. Less common symptoms are herpes, hyperidrosis and erythema of the palms and soles. Most of these symptoms, particularly itching, are prodromal, forecasting the development of a serious consequence if arsphenamin therapy is continued.

A review of the symptoms of acute and chronic arsenical poisoning is made with particular reference to the symptoms observed in the reported occurrence of epidemics of arsenical poisoning—the Paris epidemic of 1828, the English epidemic occurring among beer drinkers in the Manchester region in 1900 and the sporadic reports of arsenical poisoning from wall paper.

Arsphenamin dermatitis usually appears first on the extremities as a macular eruption which soon becomes scaly. The eruption on the trunk may be morbilliform or large, blotchy, erythematous scaly lesions. If further progress takes place it is seen as a generalized erythema with considerable scale formation, or what is more properly called erythrodermia. The process may stop here or develop into a frank dermatitis exfoliativa. In all of the above there is considerable scale formation and itching.

At times the eruption may be papular or vesicular, which is usually associated with scaly macules. In the acute cases there is swelling of the extremities, this together with erythematous and vesicular lesions resembles an acute dermatitis of external origin. In the acute cases there is often congestion of the mucous membranes. There may be fever, prostration of the patient and gastrointestinal symptoms.

The duration of arsphenamin dermatitis is variable, the mild cases in which only a few scaly macules are present being of short duration provided the administration of the drug is suspended. In the more severe cases—erythrodermia and dermatitis exfoliativa—the duration is often many weeks.

In the writer's experience arsphenamin dermatitis has occurred most frequently in those patients in whom, through a faulty venipuncture in the administration of arsphenamin, the drug is

injected outside the vein, resulting in a "local reaction." The latter appears to sensitize the individual to arsenic. A faulty venipuncture should therefore be assiduously avoided during treatment.

The occurrence of arsphenamin dermatitis, it is thought, is due to a too complete oxidation of arsphenamin after injection. The fate of arsphenamin after injection is not definitely known, its toxicity is intimately associated with the degree of oxidation.

All the causes which bring about a too complete oxidation of arsphenamin are not known. The conjoint, intensive use of arsphenamin and mercury is perhaps one cause. It has been pointed out, notably by Weschelman, that mercury through its nephrotropic action retards the elimination of arsphenamin. This retarded elimination may result in a too complete oxidation of the drug.

The incidence of arsphenamin dermatitis is variably stated by different writers. Brauer noted its occurrence in 1 per cent of the cases. Lucey in the course of 600 injections saw a limited erythema in 1 case. Jones and Gibson in the course of 1320 injections experienced 1 severe case of dermatitis, which recovered. Harrison in the course of 80,000 injections administered to about 10,000 patients, observed 26 severe, 24 moderately severe and 74 classified as mild or trivial, including limited urticaria, or a total of 124 cases of all kinds.

Other cutaneous reactions appearing after arsphenamin therapy are: Vasomotor reaction, also known as anaphylactoid symptoms or nitritoid crisis, is the most frequent and familiar. It occurs during or immediately after an injection as a vivid redness which starts upon the upper part of the chest, ascends, involving the neck and face; there is associated a sense of pressure in the chest, sometimes coughing, congestion of the conjunctiva, a rise in blood-pressure and a full, bounding pulse. The phenomenon is a transient one. Fatal cases, however, have been reported. The cause is not definitely known, although many explanations have been given.

Urticaria, another vasomotor reaction, may occur during or

immediately after the injection. This reaction is comparatively rare, but when it does occur then it usually succeeds a severe vasomotor reaction. It is more common as a later event. These vasomotor disturbances may be prevented or at least controlled by the preliminary injection of adrenalin or atropin or by first injecting a minute amount of arsphenamin and the remainder about ten minutes later.

The occurrence of herpes labialis and, occasionally, herpes are very infrequent after arsphenamin.

Pigmentation after arsphenamin is very rare. It presents the same features as the pigmentation appearing after prolonged administration of arsenic.

The patient whose photograph is shown in the lantern slide, developed pigmentation after one hundred administrations of arsphenamin.

After each arsphenamin injection there may occur in some patients a localized erythema sharply circumscribed which always appears at the same site. German writers have styled this phenomenon "fixed" arsphenamin exanthem.

A purpuric eruption after arsphenamin has been reported. The writer has seen two such cases.

The Herxheimer Reaction. In all cases of untreated syphilitics in the acute eruptive stage there occurs an accentuation of the eruption within twenty-four hours after the administration of arsphenamin. With the accentuation of the eruption there may be fever and constitutional symptoms. This phenomenon is known as the Jarisch-Herxheimer reaction. This reaction, as was originally described, was a local one—an accentuation, reddening and swelling of the macular and papular rashes occurring within twenty-four hours after the use of mercury. Its occurrence was later given as a further proof that salvarsan exerts a powerful, direct effect on the treponema. Before the discovery of the Treponema pallidum this circumstance was frequently used for diagnostic purposes (a diagnosis by the method of *ex noncentibus*), in order to determine whether isolated skin lesions which were only just visible might be pronounced roseola or not.

Ehrlich regards the Herxheimer reaction and similar phenomena observed in salvarsan therapy as an inadequate action of the injection. In his opinion in such cases the parasites are not at once destroyed but instead only irritated, and in this condition produce an increased quantity of toxins.

Besides this "local" reaction Neisser mentions a "general" one after treatment with arsphenamin which is characterized by transitory increase of the headache in cerebral syphilis and of the lightning pains in tabes.

At the present time the term "Herxheimer reaction" is used in a still more general way than Neisser's "general" reaction. It is given as the explanation of the "provocative" Wassermann reaction. It is used to explain local reactions other than in the original sense, for instance, a rupture of an aneurysm following the administration of salvarsan or acute yellow atrophy of the liver subsequent to jaundice and arsphenamin therapy.

In conclusion it may be stated that the too frequent administration of arsphenamin, daily or bi-weekly injections, is of questionable safety. It is of considerable importance that the patient should be treated as well as the disease. If intensive treatment is given it is the consensus of modern opinion that arsphenamin and mercury should not be given conjointly. The tolerance of the patient to arsphenamin should be determined by carefully noting the nature of reactions after injection of the drug. If any of the already mentioned symptoms of intolerance appear it is important to temporarily abandon treatment, or in lieu of this to increase the interval between injections or to give smaller doses of the drug.

DISCUSSION

Dr. S. Solis-Cohen: I would like to ask some questions on this interesting contribution. It is a subject that someone ought to write a book about one of these days. I understood Dr. Klauder to say that the dermatitis usually starts on the extremities, and in some cases extends rapidly and terminates fatally. Please tell us something about arsphenamin and means by which such fatalities may be avoided.

Dr. Morris: After seeing the results of salvarsan injections in these patients photographed, one wonders whether syphilis is any worse than the disease that has been produced. I would like to ask Dr. Klauder about what percentage of cases treated with arsphenamin develop serious skin eruptions?

Dr. Klauder: Harrison reported 80,000 injections administered to about 10,000 patients, 124 of whom developed cases of dermatitis, more than 50 per cent of which were classified as mild or trivial.

In reply to Dr. Cohen's question, it is of importance that the patient be watched carefully as to the effect of the injections so as not to administer the arsphenamin too frequently.

Paroxysmal Tachycardia: Unusual Types and a Note on Treatment by Quinidin Sulphate

BY C. C. WOLFERTH, M.D.

(*Abstract*)

Paroxysmal tachycardia is neither a very common nor an unusually rare form of abnormal cardiac rhythm. It has been found in approximately 1 per cent of the cases studied in the cardiographic laboratory in the University Hospital. To this should be added at least as many more cases in which the diagnosis had been made clinically, but no tracing of the abnormal rhythm could be obtained.

Much has been learned regarding the mechanism of paroxysmal tachycardia by electrocardiographic research. There is believed to be a sudden assumption of the pacemaking function by some ectopic focus from which impulses to contraction are discharged rapidly and regularly. The cause is not known, but probably temporary increase in excitability in the ectopic focus plays an important part. According to the location of the source of the abnormal rhythm, paroxysmal tachycardia is divided into three types: (1) Auricular, (2) nodal (auriculoventricular), and (3)

ventricular. Most cases are of the auricular type, the other two being extremely rare.

During the last few years a number of cases have been studied by electrocardiograph in the University Hospital in which unusual phenomena have been observed.

Case I.—Paroxysmal auricular tachycardia. There was nothing unusual about the attack itself, but after the resumption of sinus rhythm the rate gradually slowed. The duration of the first cycle was 0.53 second and the ninth 1.2 seconds.

Case II.—Paroxysmal auricular tachycardia. Premature ventricular contractions followed by compensatory pause during an attack of auricular tachycardia with a rate of 225.

Case III.—Paroxysmal auricular tachycardia. "Status paroxysmal tachycardia." Brief frequently repeated attacks of paroxysmal tachycardia with intervals of normal rhythm often lasting for only a few cycles. The patient was observed for two months and gave a history of the same condition for a number of months previously.

Case IV.—Paroxysmal auricular tachycardia. Incomplete heart-block with dropping of ventricular beats during attacks.

Case V.—Paroxysmal auricular tachycardia. In some attacks incomplete heart-block as in Case IV. In other attacks there was no heart-block.

Case VI.—Paroxysmal auricular tachycardia with long *P–R* intervals, so that the *P*–wave fell in the preceding ventricular complex between the *QRS* and *T*–waves. Tracings of onset and offset distinguish from nodal tachycardia.

Case VII.—Ventricular paroxysmal tachycardia. The ventricular complexes are abnormal and differ widely from those

observed when the rhythm was normal During attacks the ventricular rate was 193 and there was an independent regular auricular rate of 125.

Case VIII.—Paroxysmal regular tachycardia with abnormal ventricular complexes interrupting auricular fibrillation. Probably ventricular in origin.

Case IX.—Paroxysm of six beats with abnormal complexes interrupting auricular fibrillation. Also probably ventricular in origin.

Case V, in whom the paroxysms had been observed over a long period and found to recur very frequently and constantly, causing her a great deal of annoyance, was treated with quinidin sulphate in the effort to prevent the occurrence of attacks. By giving up to 2.4 gm. a day this could be done. Twice the dose was greatly cut down and each time the attacks returned. Finally the attacks could be prevented by 2 gm. a day. This amount was tolerated well; there was not only relief from the unpleasant symptoms but improvement in strength. The large dosage was partly necessary because of the unusual size of the patient, who weighed 240 pounds, but in addition it seemed that she had an unusual toleration of the drug. Electrocardiograms after the large dosage showed no alterations in conductivity and no changes in the ventricular complexes.

DISCUSSION

Dr. Patterson: Dr. Wolferth has presented a very interesting group of records of cases of paroxysmal tachycardia. I am in agreement with him and his interpretations of the records would be my own. If one takes the ordinary grade of paroxysmal tachycardia, with sudden onset and sudden offset, most of those I have seen have been without signs of important damage. Some of them present very frequent attacks, but usually they are short seizures; others present long attacks, and they are infrequent ones.

I know one case of a woman having an attack lasting eleven days, then an interval of three days and another paroxysm lasting six days. Her attacks came on in one or two hours.

I would like to express myself on the use of quinidin in cardiac disturbances. It seems to me that two or three fundamentals should be laid down. In the first place quinidin is a protoplasmic poison. Pharmacologists agree in that conclusion; clinically we have evidence of it.

The second point: It seems to me it is not whether quinidin will control a given mechanism of the heart so much as whether it will improve the heart sufficiently—whether it will overcome cardiac failure. Of course, if it will control the mechanism of the heart to overcome cardiac failure then it is of value.

The third point is: It is somewhat difficult in paroxysmal disorders to determine the value of a drug. Recovery may be due to a spontaneous tendency. There can be no question but that in certain cases there is value in the use of quinidin, but it is not accomplished by giving it to a degree that it is dangerous. It seems to me that the use of quinidin should be restricted to hospitals in which the effects can be studied. It has not come to a point where it can be generally accepted as a drug to be used in paroxysmal diseases of the heart.

Dr. Wolferth: I heartily endorse what Dr. Patterson said about the use of quinidin, and I do not want to advocate the general use of it. As I said before, quinidin is in the experimental stage, and I am very fearful of experimental stages, particularly in patients who do not have good heart action.

The bad results of quinidin do not seem to be explainable by observation of the heart muscle. Perhaps thrombi may form in the furthermost recesses of the auricles of the heart and cause the thrombolic pneumonia of some cases reported.

I also recognize the value, as Dr. Patterson has pointed out, of the difficulty of recognizing the effect of treatment of paroxysmal features. However, we had this patient under observation for two months at a time in the hospital—under close observation all of the time—and there were days when with no treatment the paroxysms would come a few minutes after the other, and on four separate occasions we would give the drug (three times lessening that quantity) and would not get results; so it seems more than a coincidence and the large doses must have had some effect; but this patient had an unusual tolerance for the drug, requiring a larger dose than would ordinarily be given.

A Report of Two Cases of Tetanus Successfully Treated by Large Doses of Antitoxin, with a Review of the Cases Treated in the Philadelphia General Hospital in the Past Ten Years

BY J. F. EDMONDS, M.D.
AND
C. A. HEIKEN, M.D.

Until a short time ago it was thought that the tetanus bacillus was found only at the site of the lesion. Hochsinger and Craite report that they have succeeded in isolating the tetanus bacillus from the heart blood and spleen of infected human beings. In a recent article by Long and Murdock in the *Journal of Laboratory and Clinical Medicine* we find the interesting report of a case in which the tetanus bacillus was found in the cerebrospinal fluid:

Case I.—W. B., white, aged thirty-seven years. Admitted to hospital, November 23, 1921, to the service of Drs. Riesman and Boston. His history is as follows:

November 12, 1921, he received a puncture wound in his foot with a rusty nail. The wound healed in a few days, but on November 18 he noticed a marked stiffness of his jaw muscles, together with pain on swallowing. On November 21 the rigidity extended to the muscles of his back, neck and abdomen. The jaw muscles became more and more rigid, until at present he can hardly separate his teeth. He has a slight hacking cough and severe pains in his chest. Every attempt to cough throws his muscles into a spasm.

Family History. Negative.

Past History. Unimportant.

Social History. Single; works as foreman in a truck garden.

Physical Examination. Adult white male, lying in bed with his body rigid from head to toes. His facial muscles are fixed in the characteristic position of the risus sardonicus. He can

barely separate his teeth. His lips and face are somewhat cyanotic. The muscles of the neck are so rigid that attempts to flex the head elevate his entire back from the bed.

Pupils are O. K.

Teeth are O. K.

Expansion of the chest is limited and the pectoral muscles are intensely rigid.

Lungs: Negative.

Heart: Normal.

Abdominal muscles stand out prominently with the inscriptiones tendineæ of the recti muscles plainly visible. The rigidity of the abdomen is characteristically "board-like."

Muscles of the extremities are very rigid. The patient is unable to raise his limbs.

The biceps, triceps, patellar, Achilles and abdominal reflexes are exaggerated. There is a definite ankle-clonus with a doubtful patellar clonus. The Babinski reflex is positive.

Within the next five days the patient had twelve severe convulsions and several minor ones. During this time he received 229,000 units of antitoxin. January 3, 1921, he was discharged.

Treatment. Small amounts of liquid by mouth. Murphy drip with glucose, 5 per cent, continuous. 229,000 units of antitoxin within five days.

Sedatives. Sodium bromide; chloral hydrate and morphin.

Case II.—P. R., colored, aged sixteen years. Admitted, August 22, 1920.

His history is as follows:

Thirteen days before admission he crushed his thumb. Three days before admission he received a puncture wound in his foot with a nail. One day prior to admission he began to suffer pains in his neck. On admission his jaw muscles were stiffened; he had had no convulsions.

Family History. Negative.

Past History. Not important.

Physical Examination. Face showed sardonic smile; jaws can be separated about one-sixteenth of an inch. Neck intensely rigid. Heart and lungs are normal. Abdominal muscles exceedingly rigid. Muscles of the extremities are not stiff. Feet show no wound. Reflexes not tested.

During the next few days the patient had several convulsions and within five days received 108,000 units of antitoxin.

Discussion. Case I had an incubation period of but six days, with a lapse of five days after the onset of symptoms before he was brought to the hospital for treatment. As it can be seen, he received within a period of five days 229,000 units of antitoxin, all but 6000 of which were administered intravenously. The antitoxin was discontinued as soon as the patient was free of convulsions for a period of twenty-four hours. The serum was given in concentrated form, the total quantity of which amounted to 200 cc. This case showed no harmful effects from the large quantity of antitoxin. On two occasions there was a slight rise in temperature following the injections. Case II. Treated by Dr. J. M. Fewell. This patient was a boy, aged fifteen years. He received 108,000 units within five days. The incubation of this case is of some doubt. The general opinion was that the crushed finger, received thirteen days before admission, was the site of the infection, although three days prior to admission he received a puncture wound of the foot with a rusty nail. Examination on admission did not show any evidence of the wound.

In combination with the serum therapy both cases were kept well under the influence of sedatives. Chloral hydrate, believed to be the most potent cord-depressant, was administered in large quantities. In Case II, 4500 units were given intraspinally. This was followed by such a severe reaction that this procedure was discontinued. Possibly this was due to the failure to give a general anesthetic.

From the case records of the Philadelphia General Hospital covering a period of ten years the following facts were of interest:

Of 22 cases treated, 6 recovered, 16 died, a mortality of 76.3

per cent. Assuming as an arbitrary classification those cases with an incubation period of ten days or less as acute, those over ten days as subacute, we find the following: There were 16 acute cases in this series, of which 4 recovered, and 6 subacute cases, of which 2 recovered. Eleven of the acute cases died within twenty-four hours after admission to the hospital. In 8 of these cases the infection followed a puncture wound of the foot with a nail, 1 followed vaccination, 1 during the puerperium period and 1 without any history of a wound. It has been the common belief that tetanus following vaccination is not due to infection at the time of vaccination but to unhygienic care of the wound afterward. The case of vaccination in this series bears this out. This individual was the occupant of a stable. In the cases in which antitoxin was given intravenously we can find no records showing that the serum was given in diluted form.

Conclusions. 1. The mortality of tetanus seems to vary directly according to the length of the incubation period.

2. Time is the all-important factor in the disease. The sooner treatment is instituted after the onset of the symptoms the more efficient is the treatment and the better the prognosis.

3. From the cases cited massive doses of antitoxin given intravenously have produced successful results without any harmful effects upon the patient.

4. Free use of sedatives is an invaluable adjunct in combination with the serum therapy.

DISCUSSION

Dr. David Riesman: I think Dr. Edmonds and Dr. Heiken deserve a great deal of credit for the care they have given in looking up these records of cases in the Philadelphia General Hospital.

The antitoxin in these cases cost the hospital $196 at wholesale, and the estimated cost at retail from the druggist is about $500. The case of the man who had violent tetanic convulsions—twelve altogether—was a most typical case, and it looks as if the large doses of antitoxin should get credit for the recovery. A very large amount, 229,000 units

in all, was given. The patient bore it well. It did not affect the kidneys in any way. It did not produce any anaphylactic phenomena, and, as far as reaction is concerned, it was borne as well as salt solution.

We were especially interested in the reflexes, which were exaggerated for quite a while after the disease had disappeared, though literature does not show that this has been noted. I do not know of any previous data on this subject.

We considered for a time the advisability of giving spinal injections, but decided finally that the irritation would be more harmful, and the outcome was very satisfactory.

Dr. Githens: I worked in Dr. Meltzer's laboratory at the time he was doing research work with magnesium sulphate and antitoxin in the treatment of tetanus. An experiment was done on dogs. The dogs were given an overdose of tetanus toxin, and after the muscles had become stiff the treatment was begun. Injections of tetanus antitoxin alone, the use of magnesium sulphate alone and a combination of the two were used, and in that work we found that the two used together gave better results than when either was used alone. When the tetanus began he could count on saving the life in every case by using the combined treatment, keeping the convulsions under control with magnesium sulphate while the antitoxin got in its work.

Dr. O. H. Perry Pepper: There were two points which interested me in Dr. Edmonds's paper: One was the small figure quoted for cases of tetanus during the war. I had expected a much higher figure than the one given. The second question: One is always interested in disorders from which they have suffered themselves. I have not suffered with tetanus, but I have experienced the urticaria which arises from the use of the antitoxin, and I would like to ask Dr. Edmonds what the appropriate treatment is for this urticaria. In my case I put in a very uncomfortable twenty-four hours with it and was the center of attention of a carload of people coming from Baltimore, because of my various scratchings, and they kept moving farther and farther away until I sat and scratched in isolation, and I should be very glad to know what the treatment is for these cases.

Dr. Sailer: In the last two years there have been two cases of tetanus in the Presbyterian Hospital: One in the surgical service, which I saw, and one which turned up rather unexpectedly in my own ward—a small colored boy, aged fourteen, was brought in. Both cases recovered, both received very large doses and both received intraspinal injections.

There was no evidence of increased irritation in the spinal cord of any kind and the patients seemed to recover more quickly.

The expense was large but was cheerfully borne by the hospital in each case.

In neither case did the convulsions extend beyond the third day.

Dr. Norris: I have not looked up any actual figures of the number of cases of tetanus in the army, but every wounded man was given tetanus serum almost immediately after being wounded—that is, as soon as he came into the field hospital or receiving hospital, wherever he was first taken. In the British service, where I was for ten months, there were about 15,000 cases treated in the entire time and only 1 case developed tetanus.

Dr. Hobart A. Hare: I did not get in in time to hear all of the paper, but the mortality rate, including subacute or chronic and acute cases of tetanus, would hardly be a guide to the percentage of cures. About 50 per cent of the chronic cases would get well anyway whether they were treated with chloral, physostigma or what was employed at the time; so every case of tetanus that got well it would be hard to say whether it belonged to that type, of which every other case gets well, or to the use of antitoxin as a therapeutic agent.

Dr. (Commander) Reed, of the Naval Hospital: In looking over the cases which occurred in Philadelphia the last few years a case was noted in which an intravenous injection of salvarsan had been given, and at the same time there was a slight abrasion of the large toe. It was never quite decided whether the infection came from this or from the injection of salvarsan.

Dr. Edmonds (closing): We wrote to the Surgeon-General's Office asking for a report on cases treated with salvarsan at the same time, and they replied that they did not come across any.

We asked them to give us a report of a number of cases of tetanus treated during the war, the incubation period and whether acute or chronic. That there were 37 cases, all of which died, is practically all they told us, and said they had no further definite information they could give us at the present time.

Dr. Beardsley: It is very peculiar they (the Surgeon-General's Office) only have a record of 37 cases which died in the army. In our center alone we had 7 cases of tetanus, all of which recovered.

Hypertension, with Especial Reference to Prognosis

BY JOSEPHUS TUCKER ULLOM, M.D.

With the advent of the blood-pressure apparatus the medical profession has looked at a very old disease from a new angle and has been able to measure the pressure in the arterial system more accurately. Before the introduction of the sphygmomanometer reliance was placed on the palpating finger and the stethoscope, and there was the high-tension pulse and the accentuated or ringing aortic sound; but a standard for comparison was lacking, and, as must always be the case without an instrument of precision, there was inaccuracy and confusion.

For about fifteen years the sphygmomanometer has been in common use and an enormous number of observations have been taken. The profession has acquired experience with the instrument and has been able to draw some conclusions from that experience. From the nature of the condition, its insidious onset and symptomless course observations on the blood-pressure over a very long period are desirable. It would be interesting to watch the course of the disease from its inception to its close. This is occasionally possible, but the hypertension is usually considerable before it is discovered. Once discovered the question arises as to the prognosis With the dissemination of knowledge relative to high blood-pressure among the laity there has arisen a feeling that the individual who has such a condition is speedily doomed, and it is but natural that he should exhibit great curiosity about the prognosis in his individual case. Hardly a day passes that the practitioner is not asked the chances for life of someone whose blood-pressure is elevated above the normal.

With the idea that an analysis of an experience of twelve years might throw light on the question and enable one to more intelligently answer questions in regard to it, this survey was undertaken.

Our present conception of hypertension is that it is either:

1. A manifestation of kidney disease; or

2. A manifestation of arteriosclerosis, pure and simple, without kidney involvement; or

3. A manifestation of some disturbance or unbalance caused by the menopause.

There may be a mixture of groups 1 and 2 and there may be other causes of hypertension, but as all the patients but one in this series fell into the first three groups, discussion will be confined to them. In this series any reading over 160 mm. systolic was considered pathological, and when the readings varied from time to time an average was taken. Those patients were placed in the nephritic group who persistently showed albumin and casts and a diminution of phthalein excretion.

Those are placed in the arteriosclerotic or essential group who showed no albumin or faint traces or only an occasional cast and no diminution in phthalein excretion.

Those are placed in the menopausal group who showed rise in blood-pressure about the age of forty-five with no albumin or casts or diminution in the phthalein excretion.

This series comprises 112 patients who were under observation for periods ranging from a few months to twelve years. In the series of 112 patients, 51 were of the nephritic group, 54 were of the vascular group, while 6 were placed in the menopausal group. One was probably due to thyroid disturbance.

Of the 112 patients, 38, or one-third, are dead. Of those who died, 29 or 76.3 per cent, were in the nephritic group and only 9, or 23 per cent, were in the arteriosclerotic group. None of the menopausal patients have died.

Of those living, 22, or 30 per cent, are in the nephritic group; 45, or 60 per cent, are in the arteriosclerotic group, and 6, or 8 per cent, are in the menopausal group.

In the nephritic group there are 24 men and 27 women. Of the 29 dead, 17 were men and 12 were women, or about 70 per cent of the men and 40 per cent of the women. In the arteriosclerotic group there were 14 men and 40 women. Of this group,

9 are dead, 3 of whom were men and 6 were women, 21 and 15 per cent respectively; 57 per cent of the nephritic group are dead, 40 per cent at the end of two years.

These figures show very clearly that the greatest mortality is in the nephritic group and they also show that essential hypertension is more common among women than among men. This is probably due to a climacteric origin of hypertension in women.

In the nephritic group those who died were under observation on an average of 2.3 years. Those who died in the vascular group were under observation on an average of 2.8 years. Those living in the nephritic group have been under observation on an average of three years. Those living in the vascular group have been under observation on an average of 3.7 years.

The cause of death, taken as a whole, was apoplexy in 15, or 40 per cent; heart disease in 16, or 42 per cent; uremia in 3, or 7.9 per cent; angina pectoris in 2, or 4.25 per cent; and carcinoma in 2, or 4.25 per cent. Several patients in this series had angina but did not die of it.

The consideration of the death-rate in those showing a systolic blood-pressure over 200 mm. gives 24 dead out of 54, a percentage of 44. Those showing 200 mm. and below were 58, with 13 dead, a percentage of 22. With approximately equal numbers in each group the mortality in those above 200 were double that below 200.

The consideration of the patients in the series showing a diastolic pressure over 100 mm. gives 54, with 27 dead, a percentage of 50. Those under 100 mm. give 58 with 12 dead, a percentage of 20.

A consideration of the ages of the patients shows that the average age of the nephritic group was 58 and the average age of the vascular group was 66. Taking the ages by decades and grouping 2 patients below 40 with the 40 to 50 decade we find in the first group 20 patients with 8 deaths. The mortality is 40 per cent. Between fifty and sixty there were 25 patients with 9 deaths, a mortality of 34.6 per cent. Between sixty and seventy there were 35 patients with 9 deaths, a mortality of 25.7 per cent. Between seventy and eighty there were 21 patients with 8 deaths or a mortality of 40 per cent. Over eighty there were 5 patients with 3 deaths, a mortality of 60 per cent.

It would seem that these figures give a curve with two peaks, one occurring between forty and sixty and the other occurring after seventy. This may be more apparent than real.

Transient paralyses were found in 24 cases of the series, a percentage of 21.4 per cent. Fifteen, or 62 per cent, are dead.

From a consideration of the facts set forth above the following conclusions are reached:

1. The cause of hypertension in men is usually chronic renal disease. In women hypertension due to vascular disease is more frequent. This is probably due to a menopausal origin of the condition in women.

2. The prognosis is much more grave in hypertension due to renal disease than it is in that due to vascular disease.

3. The cause of death is generally cardiac failure and apoplexy in about equal numbers.

4. Blood-pressures of over 200 mm. are of grave significance, the mortality above 200 mm. being double that below. A diastolic of over 100 is an even more serious manifestation.

DISCUSSION

Dr. Piersol: It is rather difficult for me to discuss this paper because it corresponds so nearly to my own observations, and the survey drawn up by Dr. Ullom is almost identical with my own along the same sort of series.

It is very interesting to me to find that some other had arrived at the same conclusions.

I have seen many cases, particularly in women, who have been almost scared to death because someone discovered they had a blood-pressure of 200 and told them they were liable to drop dead. I recall a woman whose blood-pressure, about fifteen years ago, was very high; the kidneys were normal, but for fifteen years the pressure was high. The systolic pressure was never under 250 and sometimes 290; there were symptoms due to high pressure, but the woman lived an ordinary course and succumbed to other diseases.

In a great many of these hypertension cases which I have observed the cause of death corresponded very nearly to those pointed out by Dr. Ullom:

Out of 60 fatal cases, one-third died after twelve years' observation; 28 per cent succumbed to cardiac disturbances, and 18 per cent died from uremia. I think that benign forms of hypertension have no prognostic significance.

Dr. H. A. Hare asked if the age of the patient might not have some significance on the prognosis, and cited a case of a seventeen-year-old girl who came into his office with a blood-pressure of 310, complaining of a headache, and who succumbed eleven days later. He thought such a high blood-pressure in such a young girl would lead one to think the prognosis would assume a grave aspect.

Dr. Norris said he thought that 20 per cent of deaths in hypertension cases due to paralysis was rather large judging from his own experience, and stated that he had seen women carry a high blood-pressure over a large number of years without serious symptoms.

Dr. Sailer: I would like to ask Dr. Ullom if he had observed hemorrhages in other parts of the body than the brain, especially small cutaneous hemorrhages in the arm or some other part of the body. I recall having seen one case of high blood-pressure in a woman, carrying 200 to 275 systole, who had a previous hemorrhage of the lung. She remarked that she was glad it did not take place in the brain. As a matter of fact, recovery seemed to be made.

All are no doubt familiar with the feature of epistaxis, which quite often has a beneficial effect.

Dr. Ullom: In answer to the question about high blood-pressure in nephritic cases, there is no doubt but that in some cases hypertension is prognostic, but hypertension in vascular cases is not significant. A great many women with high blood-pressure have been under observation for long periods of time. The longest one I have had was a woman whom I had under observation for fifteen years. She had a blood-pressure of 230 systolic and 130 diastolic, with no signs of kidney trouble. Her husband had a high blood-pressure with casts in the urine. They were planning a trip to California; this was fifteen years ago. I told them they had better put it off for a year. At the end of that time nothing had happened, so I told them it was all right for them to go, which they did. They are both living, although the woman is not in very good shape now. In regard to Dr. Sailer's question about hemorrhages in other parts of the body than the brain, I do not remember seeing hemorrhages except in the conjunctiva, and, of course, epistaxis is common; several patients had epistaxis in large amounts and were very much alarmed, but it usually is beneficial.

FEBRUARY 27

Infectious Mononucleosis

BY WARFIELD T. LONGCOPE, M.D.

Under the terms "akute sublymphoemische lymphomatosis," "glandular fever," "infectious mononucleosis" and "acute benign lymphoblastosis" there has been described a symptom-complex which, though not very common, is of sufficiently frequent occurrence to be of importance both from the practical and from the theoretical standpoint. The matters which are of practical importance have to deal with the diagnosis and the etiology, and should the disease prove to be an entity, with the mode of transmission and epidemiology; the matters of theoretical importance have to do with the classification of this symptom-complex and its relationship to other diseases of the lymphatic apparatus and most particularly to leukemia.

In 1889, E. Pfeiffer[1] described a condition in children which he called "Drusenfieber," which was characterized by a short febrile course accompanied by enlargement and tenderness of cervical lymph nodes. The disease occurred often in house epidemics. During the next fifteen to twenty years there were numerous references in literature to this condition of glandular fever, notably by Korsakoff,[2] Lublinski,[3] Schlissner,[4] Terflinger[5] and Jones.[6] In 1896, J. Park West[7] reported an epidemic of 96 cases from Eastern Ohio. The clinical descriptions in these older papers picture with considerable detail a febrile disease lasting nine to twenty-seven days accompanied by an enlargement of the lymph nodes and especially those of the neck, but at times of all the superficial groups as well. In some instances there was abdominal tenderness and frequently the spleen and the liver were enlarged. Mention is sometimes made of the synchronous occurrence of infections of the upper respiratory tract, but frequently it is stated specifically that there was no accompanying tonsillitis. Recovery was the rule.

Unfortunately in none of these reports is there any mention of the leukocyte count or of the condition of the blood, and though Tidy and Morley,[8] who have recently reviewed the clinical aspect of this whole subject, regard the instances of glandular fever occurring in such epidemics as identical with the condition called today infectious mononucleosis, there is no proof that this identity exists.

The very unusual occurrence of a marked mononucleosis accompanying an acute infection has attracted from time to time the attention of several observers. Turck,[9] in 1907, recorded 3 such cases that have frequently been alluded to in literature. One case with angina and glandular enlargement resembled an acute leukemia with recovery. Marchand[10] recorded a similar case in 1913, and in the same year Cabot[11] reported 4 cases of acute local infections associated with lymphadenitis in which blood counts showed that the leukocytes varied from 9000 to 30,000 with a percentage of lymphocytes varying from 67 per cent to 82 per cent. During the last year Sprunt and Evans[12] have reported, under the term of infectious mononucleosis, 6 similar cases, all of which presented much the same clinical picture. Within the same year Bloedorn and Houghton[13] have described 4 cases which they term benign lymphoblastosis; Tidy and Morley 3 cases, and Morse,[14] under the term "glandular fever," 2 more cases. There are thus on record about 20 cases in which blood examinations have been made, though in only a few of these has any attempt been made to analyze accurately the blood picture or to investigate other important features of the disease.

It is therefore with an intent to add some information on these points that the following 9 cases are reported.

The clinical course in all the reported cases presents a fairly uniform picture.

The disease has occurred usually in young adults or in adolescents. Curiously enough many of the patients have been medical students or young physicians.

The onset is rather gradual, with malaise, headache and an irregular fever occasionally accompanied by chills. In many

instances at the onset there is a pharyngitis, an actual tonsillitis, a tracheitis or a cough. Sometimes the lymphoid tissue of the pharynx becomes much swollen. Very frequently the patients complain of sweating. In a few instances there has been abdominal pain with nausea and vomiting. Rarely the first sign of the disease noticed by the patient has been an enlargement of the cervical lymph nodes. More frequently the cervical lymph nodes become enlarged and tender during the first week of the disease. They may reach 1 or 2 cm. in diameter and are quite firm. In some instances the enlargement is confined to the cervical nodes, but frequently the axillary, inguinal and even the epitrochlear and possibly the bronchial lymph nodes are involved and those located superficially become swollen, firm and tender. In most cases during the first and second weeks the spleen is enlarged, becomes readily palpable and is tender. By the seventh day the mononucleosis is well marked, and from this time until the tenth to the eighteenth day the leukocytes increase in numbers and the mononucleosis advances. The fever, which is often mild and rarely goes above 102° and 103,° continues irregularly until the tenth to the twentieth day and then gradually subsides. With the fall in temperature the symptoms subside, the lymph nodes recede, the spleen diminishes in size, the leukocytes fall and the mononucleosis gradually disappears. Convalescence is rapid and uneventful, though the lymph nodes may remain palpable for weeks and a slight increase in the mononuclear cells of the blood may persist for some time.

There is almost nothing known about the pathology of the disease. The lymph nodes from three of the cases reported by Sprunt and Evans were examined histologically. The sections are reported as being quite similar and as presenting a picture that could not be differentiated, save in the degrees of hyperplasia from lymphatic leukemia. The sections presented no indications of Hodgkin's disease, tuberculosis or lymphosarcoma.

In two of the cases reported here lymph nodes were excised and examined histologically. An axillary lymph node removed from P. E. (Case 2) on February 16, 1915, presented the following appearance:

"From the left axilla the lymph node has been excised. This one section shows almost complete loss of normal structure. There is marked lymphoid hyperplasia of the germinal centers, the cells of which show karyorrhexic and karyocinetic nuclei. In the lymph spaces between the cords there is active proliferation of the epithelioid cells of the reticulum with the formation occasionally of large uninuclear cells almost of giant size. A few of these large epithelioid cells are also mixed in with the cells in the lymph cords. Occasionally an eosinophilic leukocyte is seen. The picture suggests very strongly Hodgkin's disease, though one would scarcely dare to make a definite and positive diagnosis."

A cervical lymph node from Case 3 presented a picture which simulated, in some respects, Hodgkin's disease but which did not allow one to make that diagnosis.

Neither bacteriological nor serological examinations have thrown any light on the cause of the disease or served even to indicate whether it is merely an unusual form of reaction to an ordinary pyogenic infection or a disease *sui generis*.

Discussion. The cases have been mistaken for tuberculosis, typhoid fever, Hodgkin's disease and leukemia. In a few instances syphilis was suspected. There is no evidence to show that the condition is related in any way to any of these diseases. The resemblance to leukemia is perhaps most striking, but the early and marked enlargement of the lymph nodes, the absence of anemia and of purpura and the histological and biological characteristics of the abnormal mononuclear elements of the blood practically exclude the possibility of considering these cases as instances of mild and transient acute leukemia.[1]

The clinical picture alone suggests very strongly that the "glandular fever" originally described by Pfeiffer is one and the same condition, but until epidemics of infectious mononucleosis are recorded or until cases of characteristic glandular fever are described in which the blood picture differs essentially from that in "infectious mononucleosis" it will be impossible to settle this

[1] Herz, A.: Die Akute Leukemia.

question. Pending the settlement of this point, however, the term "infectious mononucleosis" is perhaps the best one to employ. It has the virtue of calling particular attention to the blood picture.

Conclusions. Nine cases of infectious mononucleosis are described. The relation of this disease to glandular fever is discussed.

The uniform character of the disease and the association of an enlargement of the lymph nodes with a striking increase of mononuclear cells of abnormal type in the blood serve to differentiate the condition from other acute infectious diseases.

If the disease is an entity, as it appears to be, the specific cause is unknown.

It resembles most closely acute leukemia but may be differentiated by many characteristics. The disease is of short duration and recovery is the rule.

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DISCUSSION

Dr. George Norris: I feel rather ill at ease in opening a discussion on a subject in which I am so deficient. My experience in these cases has been very limited, but I happened to see a young man, about ten years ago, whose symptoms, as I now remember, were almost identical with the cases Dr. Longcope has described tonight. The young man at the beginning had an acute infection of the throat, which later developed

into marked enlargements of the glands of the neck, which gave us a great deal of worry. He had profuse sweating, and as Dr. Longcope mentioned, a study of the blood disclosed the striking feature of an increase of mononuclears, the exact percentage of which I have forgotten; but the thing definitely impressed upon my mind was the fact that I was never able to make to myself a satisfactory diagnosis, but put it down as glandular fever, called to my attention tonight.

Dr. Kern: There is little I can add to the clinical picture Dr. Longcope has presented. I had an opportunity to see three of these cases, and one point which struck me with the first patient, who was a young man of about twenty years of age, who complained of a sore throat, was that one of the tonsils showed an ulceration. The appearance of the tonsils was striking, swollen but not particularly edematous looking. He had enlarged cervical lymph nodes and the blood findings showed an increase of mononuclears, as Dr. Longcope has described.

The third case was a young man of about the same age. The first thing that impressed me was this peculiar appearance of the tonsils; they were edematous looking; the cervical nodes were considerably enlarged and tender; an increased leukocytosis, the count showing 23,000, of which 75 per cent were mononuclear. The tonsils were removed about three weeks after the infection had subsided, studied by Dr. Farley, and I believe showed nothing but simple hyperplasia. The question of the relation of Vincent's infection with two of these cases interested me. Out of five or six cases reported all but one showed Vincent's infection, and finally a man who reported one of these cases some five or six years ago referred to an unpublished series of Vincent's angina, all of which were attended by mononucleosis.

Dr. Herbert Fox: I am very glad to hear this clearing of the atmosphere about "glandular fever." I have seen a few cases but have not been able to present as clear a picture as Dr. Longcope has presented. I was disappointed that he did not lay more stress on the possible etiological importance of the organisms associated with Vincent's infection. Some years ago one of the men who worked in the Pepper Laboratory was appointed to look up all cases of Vincent's infection and allied cases at the University Hospital and Children's Hospital. He was unable to discover more than a few. He was able to secure several cases of increased polynuclear count and some with very definite glandular conditions.

In reference to the type of cell which Dr. Longcope mentioned, we have been looking at them with the idea that they are youthful mononuclears. The young type of mononuclear has a small dark nucleus and

much clear cytoplasm, and seem not at all associated with larger epithelioid cells.

In reference to the picture of excised cervical gland tissue and the very large number of mononuclear cells in the blood I have not seen an excised gland in these cases but did study the tonsils removed from the case to which Dr. Kern referred.

The enormously enlarged follicular centers could easily be the origin of the large type of mononuclears seen in the blood.

In reference to the nomenclature I would suggest some term in the name to direct attention to the lymphatic nodes and also the mononucleosis.

Dr. Beardsley: In 1916, while making the rounds with one of the interns who happened to have a very pale complexion naturally, he said he felt rather badly, and before leaving the ward had a violent chill. I saw him some two hours after and he was sweating very profusely; both the spleen and the liver were enlarged, and although he had been on duty up to a couple of hours before that time, he was greatly prostrated. His blood count showed 86 per cent leukocytes. He was quite ill for about ten days, and the question came up as to whether it might be leukemia, but he made an uneventful recovery in about three weeks. His blood still showed 92 per cent of leukocytes, and it was six months before his blood picture became normal.

There was one point in connection with this case that Dr. Longcope apparently did not encounter, and that is the extreme prostration. This young man was taken so violently ill his family were very much alarmed about him, and his extreme prostration was quite unusual in my experience.

Dr. Riesman: I was with Dr. Leopold on a case of this nature in a girl, about fifteen years old. They had had a cold and a grippe infection in her house. The girl had a cold and had gone out and played basket-ball. She came in either the same or the next day and was taken with a high fever, 105°, and when I saw her with Dr. Leopold she had enlarged glands in the neck and axillary; the spleen was enlarged and she had a white ring around her mouth like scarlet fever; there was no sore throat; the tonsils were out and there was no scarlet-fever rash. The blood count showed a leukocytosis of 16,000, but she got well entirely, and a diagnosis of glandular fever seemed to be the only thing that would fit the case.

I think Dr. Longcope has given us such a clear picture that we shall be seeing this disease in Philadelphia quite often. I am with Dr. Fox, however, that the name is not one that will make it easily diagnosticated by the general practitioner, and after all he is the one who will come across

it oftener; so if Dr. Longcope is going to coin a name it ought to be something that would direct attention to the relative proportion of white cells in the blood.

Dr. Longcope: In regard to Vincent's infection of these cases, I think there were four altogether: Three of them showed organisms in the blood; but all of the cases did not have tonsillitis. I think these organisms occur as incidentals accompanying the increase in leukocytes; but I think the consensus of opinion is that these normal cells are all youthful cells, and probably the small leukocytes of the blood.

Prostration was considered in a few cases but not in all, and is, I think, unusual. The first symptom is probably marked inflammation of the throat, then the enlarged lymph glands and then the mononucleosis.

As regards the names, I took them as they appeared; glandular fever had the priority, then infectious mononucleosis. I was simply using the terms that had been employed in describing this disease.

Foreign Bodies in the Air Passages: Symptomatology and Diagnosis

BY CHEVALIER JACKSON, M.D.

(*Abstract*)

The Initial Symptoms. These are choking, gagging, coughing and wheezing, often followed by a symptomless interval. A foreign body may be in the larynx, trachea, bronchi, nasal chambers, nasopharynx, fauces, tonsil, pharynx, hypopharynx, esophagus, stomach, intestinal canal, or may have been passed by bowel, coughed out or spat out, with or without knowledge of the patient. Initial choking, etc., may have escaped notice or may have been forgotten.

Laryngeal Foreign Body. One or more of the following laryngeal symptoms may be present: Hoarseness, croupy cough, aphonia, odynphagia, hemoptysis, wheezing, dyspnea, cyanosis, apnea, subjective sensation of foreign body. Croupiness usually means subglottic swelling. Obstructive foreign body may be

quickly fatal by laryngeal impaction on aspiration or on abortive bechic expulsion. Lodgment of a nonobstructive foreign body may be followed by a symptomless interval. Direct laryngoscopy for diagnosis is indicated in every child having laryngeal diphtheria without faucial membrane. (No anesthetic, general or local, is required.) In the presence of laryngeal symptoms we should, I think, consider the following possibilities:

1. A foreign body in the larynx.
2. A foreign body loose or fixed in the trachea.
3. Digital efforts at removal.
4. Instrumentation.
5. Overflow of food into the larynx from esophageal obstruction due to foreign body.
6. Esophagotracheal fistula from ulceration set up by a foreign body in the esophagus, followed by leakage of food into the air passages.
7. Laryngeal symptoms may persist from the trauma of a foreign body that has passed on into the deeper air or food passages or that has been coughed or spat out.
8. Laryngeal symptoms (hoarseness, croupiness, etc.) may be due to digital or instrumental efforts at removal of a foreign body that never was present.
9. Laryngeal symptoms may be due to acute or chronic laryngitis, diphtheria, pertussis, infective laryngotracheitis and many other diseases.
10. Deductive decisions are dangerous.
11. If the roentgen ray is negative, laryngoscopy (direct in children, indirect in adults) without anesthesia, general or local, is the only way to make a laryngeal diagnosis.
12. Before doing a diagnostic laryngoscopy, preparations should be made for taking a swab specimen and for bronchoscopy and esophagoscopy.

Tracheal Foreign Body. (1) "Audible slap," (2) "palpatory thud," and (3) "asthmatoid wheeze" are pathognomonic. The "tracheal flutter" has been observed by McCrae. Cough, hoarseness, dyspnea and cyanosis are often present. Diagnosis

is by roentgen ray, auscultation, palpation, bronchoscopy. Listen long for "audible slap," best heard at open mouth during cough. The "asthmatoid wheeze" is heard with the ear or stethoscope bell (McCrae) at the patient's open mouth. History of initial choking, gagging and wheezing is important if elicited, but is valueless negatively.

Bronchial Foreign Body. Initial symptoms are coughing, choking, asthmatoid wheeze, etc., noted above. There may be a history of these or of tooth extraction. At once, or after symptomless interval, cough, blood-streaked sputum, metallic taste or special odor of foreign body may be noted. Nonobstructive metallic foreign bodies afford few symptoms and few signs for weeks or months. Obstructive foreign bodies cause atelectasis, drowned lung and eventually pulmonary abscess. Lobar pneumonia is an exceedingly rare sequel. Vegetable organic foreign bodies such as peanut-kernels, beans, watermelon seeds and the like cause at once violent laryngotracheobronchitis, with toxemia, cough and irregular fever, the gravity and severity being inversely to the age of the child. Bones and metallic bodies after months or years produce changes, which cause chills, fever, sweats, emaciation, clubbed fingers, incurved nails, cough, foul expectoration, hemoptysis—in fact, all the symptoms of chronic pulmonary sepsis, abscess or bronchiectasis and many signs which may suggest pulmonary tuberculosis. The apices, however, are normal and bacilli are absent from the sputum.

The Roentgen-ray Diagnosis. In its most marvelous developments this will be demonstrated by my distinguished colleague, Dr. Willis F. Manges, whose technical skill, keen eye, wonderful judgment and marvelously accurate work has been invaluable to me.

Physical Signs. The following is a brief résumé of the results of the work of the various eminent internists who have collaborated with me: The physical signs vary in different cases and at different times in the same case. The results of my endoscopic studies of the mechanism of the production of the physical signs throw much light, I think, on the subject, as I shall now endeavor

to show by making a few chalk drawings. Secretions, normal and pathologic, may shift from one location to another; the foreign body may change position admitting more, less or no air, or it may shift to a new location in the same lung or even in the other lung. A recently aspirated pin may produce no signs at all. The signs of diagnostic importance are chiefly those of partial or complete bronchial obstruction, though a nonobstructive foreign body, a pin for instance, may cause limited expansion (McCrae), or, rarely, a peculiar rale or a peculiar auscultatory sound. The most nearly characteristic physical signs are: (1) Limited expansion; (2) decreased vocal fremitus; (3) impaired percussion note; (4) diminished intensity of breath sounds distal to the foreign body. Complete obstruction of a bronchus followed by drowned lung adds absence of vocal resonance and vocal fremitus, thus often leading to an erroneous diagnosis of empyema. Varying grades of tympany are obtained over areas of obstructive or compensatory emphysema. With complete obstruction there may be tympany from collapsed lung for a time. Rales in case of complete obstruction are usually most intense on the uninvaded side. In partial obstruction they are most often found on the invaded side distal to the foreign body, especially posteriorly, and are often most intense at the site corresponding to that of the foreign body. A foreign body at the bifurcation of the trachea may give signs in both lungs. Early in a foreign-body case diminished expansion of one side, with dulness, may suggest pneumonia in the affected side; but the decreased vocal fremitus and the diminished breath sounds with absence of or decreased vocal fremitus and absence of typical tubular breathing should soon exclude this diagnosis. Bronchial obstruction in pneumonia is exceedingly rare.

DISCUSSION

Dr. McCrae: There is another paper to follow and I think we are not going to have time for a discussion, so I move that we have no discussion of this paper.

The motion not being seconded, Dr. McCrae said: The man who makes a diagnosis of pneumonia fails to keep general principles in mind. There are two important causes, mechanical and inflammatory. The mechanical may not cause any obstruction at all, probably only insufficient expansion; partial plugging of the bronchus may cause a shifting of signs. There is no resonance in a completely plugged bronchus. The inflammatory signs, of course, are different. Personally, I have yet to see the first case of pneumonia accompanying a foreign body. It may occur, but I believe it is rare.

If the case is not easily diagnosticated, and is one that does not need immediate action, tell the patient to come back later in the day or the next day; there may be a shifting of signs which will make diagnosis more sure. It should not be difficult to work out what the signs mean.

Dr. Foulkrod: I do not think there is much I can add to what Dr. Jackson has said. A case came to my attention which Dr. Fetterolf diagnosticated as a foreign body in the lung. It proved to be a peanut, although the roentgen ray had failed to reveal it. When the bronchus is plugged completely the diagnosis is definite, but the physical signs made diagnosis difficult in this case, and apparently Dr. Manges, who had taken many roentgen rays, could not get a picture of it.

Dr. Manges: (Paper postponed on account of lateness of the hour.) I do not know that I can add anything particularly. I should like to say in connection with the point which Dr. Foulkrod brought up, the probabilities are at the time this case came up we did not know anything about organic foreign bodies without having some sort of symptoms present; but since that is the burden of my story when I do present it, I will not speak of it now.

Dr. Jackson referred to the help which he had in one or two foreign-body cases which he showed; the only help I have been was to develop two roentgen-ray tubes so one could roentgen-ray at right angles, which has enabled him to take out foreign bodies that have been inhaled, and he has also taken out a bullet which had been shot in through the back and had lodged very low down in the lower right lobe of the lung. I hope that everyone who has heard Dr. Jackson's talk will take seriously the lesson of making a diagnosis of pneumonia in foreign-body cases, especially in children who show atypical chest disturbances. Recently, I went to Altoona to address a society there. I got there in the morning and one of the doctors said, "I almost had a peanut case for you," but a roentgen ray had been taken which did not show it, and the child had been sent home. He told me about the case, and I said, "Doctor, the peanut is still there." The grandmother brought the child back

and she said, "I know it is there; I can hear it," and she could hear the slap that Dr. Jackson has mentioned. Two weeks afterward Dr. Jackson got another case from the same locality, so I feel that having an opportunity to drill into the men of Altoona and that section just at that time the possibilities of a mistake in diagnosis has saved one and perhaps two children's lives in that way.

Dr. Chevalier Jackson: I doubt if anybody present realizes, as I do, what this work means. For years and years and years I watched for these peanut cases. Children would come in very sick with all the appearances of influenza (I will call it influenza by courtesy) or acute bronchial conditions, and for years and years I wondered whether I ought to do a bronchoscopy. Today it is different. If Dr. Manges says the peanut kernel is in a certain place, there is where I find it. For years and years I was picking peanut kernels out of the wrong lung, and after we began using the roentgen ray I thought the plates were not being interpreted right until the fact was developed that in partial obstruction the signs were more pronounced on the uninvaded side. For some time I supposed that the foreign body has been lodged in the lung that showed the signs and had been coughed up and reaspirated on the other side. In the case which Dr. Manges spoke of, where we took out the apple stem, they said the child choked on a piece of apple, but we knew a piece of apple would not stay that long; but Dr. Manges said there was a foreign body there, and I went down and got the apple stem. This work comes nearer to 100 per cent correct than anything I know of in clinical medicine.

The Mechanism of Physical Signs, with Special Reference to Foreign Bodies in the Bronchi[1]

BY CHEVALIER JACKSON, M.D.

It would seem interesting for me to illustrate for the internists present the bronchoscopic views of the most frequently seen departures from the normal in the interior of the bronchi. In other words, to consider the changes in physical forms that must

[1] Report of a "chalk talk" given at the meeting of the Section on General Medicine of the College of Physicians, February 27, 1922.

necessarily influence, according to the laws of physics, the physical signs as elicited by the internist examining through the barrier of the thoracic wall. At the outset it should be said that while I have been training my eyes and fingers to the requirements of endoscopic technic, the training of my ears to the niceties of auscultation and percussion have been neglected. Fortunately, however, my patients and I have had the advantage of a number of the most skilled internists. Since roentgen-ray diagnosis of nonopaque foreign bodies in the lung by the discovery of Iglauer and its development to a high degree of perfection by my colleague, Dr. Willis F. Manges, it may be said that the roentgen-ray is our most valuable means of diagnosis in all cases of suspected foreign body in the lung; but this does not lessen the necessity for the study of the physical signs. It would be a great misfortune if careful physical examination were neglected in any case. Every foreign-body case should be gone over as carefully as if the roentgen-ray had not been discovered and the signs should be recorded and interpreted *before* the roentgen-ray examination, so the examiner will not be biased, or, as is often the case, hindered by his efforts not to be biased. It is so much easier simply to record "in cold blood" and interpret the findings as elicited with no knowledge of the ray-findings, that all of the internists with whom I have worked preferred to work that way.

Changeability of Physical Signs. One of the outstanding features of the physical signs, especially in foreign-body cases, is their changeability, as pointed out by McCrae.[1] This changeability is well illustrated in all the bronchoscopic views except 1 and 7. The bronchial movements and the shifting of the secretions, the granulations and the foreign body, all contribute to the changeability of the physical signs. The outstanding feature of all bronchoscopic endobronchial pictures is also the incessant change. The bronchoscopist, without moving his bronchoscope from one location, sees a never-ending panoramic

[1] Physical Signs of Foreign Bodies in the Bronchi, Am. Jour. Med. Sci., March, 1920, No. 3, clix, 313.

series of changes from one image to another. The image is modified by:

(*a*) The bronchial movements.

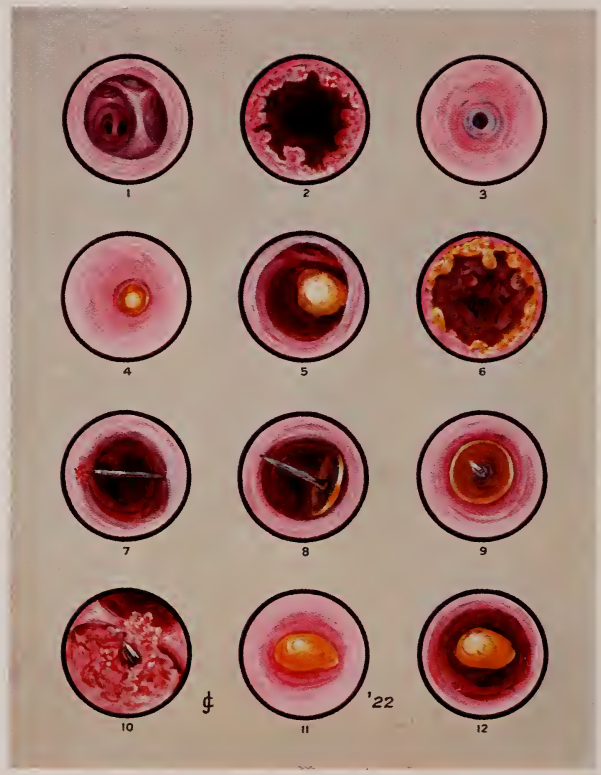
(*b*) The presence, absence or shifting of secretions.

(*c*) The presence and movements of foreign bodies.

Necessarily, in obedience to physical laws, the physical signs must in some degree change also. That they do thus change is abundantly evidenced by the clinical observations of the bronchoscopic clinic, a few of which are herewith illustrated.

The Normal Bronchial Movements. These are probably not fully realized by anyone who has never looked through a bronchoscope into the normal living lung. It is an awe-inspiring sight. The bronchi are not rigid tubes like gaspipes. They expand, contract, elongate, shorten; they bulge out, dinge in, bend and twist to an astonishing degree. Often the lumen of a normal bronchus proximal to a foreign body is noticed to be obliterated so as completely to hide a foreign body from view, simply by the momentary contraction of the normal walls of the bronchus. The same thing occurs from momentary bending and dinging in of the bronchial wall. These movements follow each other in rapid succession. They are rhythmically evident during respiration. Expansion and lengthening of a bronchus occurs during inspiration, contraction and shortening during expiration. These movements change the picture at the rate of eighteen or more times per minute. They are enormously exaggerated during the expiratory blast of cough and the deep inspiration that immediately follows cough. The transmitted movements of the heart and great vessels change the picture at the pulsatory rate of 70 or more times per minute.

The Shifting of Secretions. Secretions, unless the bronchus is completely occluded (by a foreign body itself or by secretions, granulations, swollen mucosa, etc.), are constantly shifting. They go upward under the influence of the cilia, the squeezing of the contractile lung, the expiratory current or the tussive blast. They may have a retrograde tendency, usually less marked under the influence of gravity and of the inspiratory current.



Photoprocess reproduction of color drawings, by Chevalier Jackson. For description see text.

Speaking broadly there is a tidal effect in the alternate accumulation of secretions and their tussive expulsion. They may be partially expelled and aspirated into the other lung, giving marked signs in the uninvaded side for a time at least.

Description of the Color Plate. Reference to the color-plate reproduction of the chalk drawings, along with the following notes of the outstanding features of the physical signs in the corresponding cases, will doubtless be of interest. To avoid confusion all signs that seemed without special significance will be omitted. By this, however, it is not meant that the signs are due to the conditions illustrated, as, of course, it is impossible to say. The clinical facts are recorded for what they may be worth.

1. *Bronchoscopic View Looking down the Right Main Bronchus of the Living Patient.* The bronchoscopic tube-mouth is at the orifice of the main bronchus. The author's belief is that the normal breath sounds are largely produced by the impinging of the air-blast on the thin sharp edges of the spurs between the branch orifices. The view is somewhat composite, inasmuch as the bechic, respiratory, pulsatory and bronchial movements prevent a simultaneous view of all the branch-bronchial orifices shown as mentioned in the paragraph on bronchial movements.

2. *View Looking down the Right Main Bronchus in a Case of Postpneumonic Pulmonary Abscess.* The walls of the bronchus are lined with exuberant granulations which have also obliterated the normal thin sharp dividing spurs seen at 1. Obviously, by the laws of physics, air rushing through such a tube must give an auscultatory sound different from the passage of air through a normally lined tube and impinging on sharp dividing spurs as shown in the preceding illustration (1). A brass horn lined with obstructing masses of grease and incrustations would give a note perceptibly different to sensitive ears from that obtained from a clean, polished, unobstructed horn. The difficulties encountered at the bronchoscopic clinic in designating a peculiar sound as characteristic of this state of a bronchial tube is due to the almost invariable association with pus produced by the

granulations. The granulations shown at 2 are often seen to flap to and fro in the respiratory current or bechic blast. They are quite often associated with the conditions shown at 5 and 6, though the latter represent other cases. Coughing up the purulent secretions may in a few moments restore the condition shown at 2. Dr. O. H. Perry Pepper elicited the following signs: Limited expansion; dulness at base; expiration prolonged and of bronchial quality; breath sounds absent at the base; vocal resonance unaltered; no whispered pectoriloquy.

3. *Arachidic Bronchitis Due to Aspiration of a Peanut Kernel Which Does Not Show.* The bronchial mucosa has swollen until only a small lumen remains. For convenience this is called a pin-hole lumen, though it may be considerably larger than a pin-hole The outstanding physical signs in this case before bronchoscopy were: Limited expansion on the invaded side; diminished, sometimes absent, breath sounds; impaired percussion note and occasionally a long wheezing expiratory rale, alternating with absence of rales.

4. *Same Case as Shown at 3 a Few Moments Later.* The pin-hole lumen has been occluded with a thick firm clot of pus which was removed with forceps. Although no physical examination was made at the moment this bronchoscopic image was seen, the inference is logical that the intermittent disappearance of all breath sounds corresponded with an intermittent occlusion of the lumen similar to that noted at bronchoscopy and shown in this and the preceding illustration.

5. *Pus Coming into the Right Main Bronchus from the Upper-lobe Bronchus (Recumbent Patient).* Partial occlusion of the right main bronchus. A few moments later the pus was aspirated into the orifice of the middle-lobe bronchus, which is here shown anteriorly (above and beyond the pus in the drawing). Physical signs: Limited expansion and coarse rales all over the right side; intermittent diminution of breath sounds over the middle lobe; impaired percussion note in the right upper lobe.

6. *Bronchus Slightly Inflamed but Free from Granulations. Pus Coming up from a Foreign-body Abscess Below.* Physical

signs, in addition to those of the abscess below, consisted chiefly of the great variety and loudness of rales heard following each other in rapid succession and which obscured all other auscultatory sounds.

7. *A Slender Bit of Steel (Shaft of a Dental Instrument) Transfixed across the Lumen of the Left Stem Bronchus.* The logical hope would be that some peculiar eolian note might be heard from the air-blast rushing past the slender wire. Nothing of the kind could be made out. Instead a most illogical and so far unexplained phenomenon was observed in this case by Dr. McCrae, namely, a limitation of expansion on the invaded side. In consideration of the fact that there was, as clearly shown at bronchoscopy and illustrated here, no obstruction to the airway, this curious phenomenon is difficult to explain. Since this case the same thing has been noted in a great many similar cases. The only other sign of note was the presence of fine "tissue-paper" rales. Both these and the limitation of expansion disappeared after bronchoscopic removal of the foreign body.

8. *A Tack in the Right Stem Bronchus.* In this position there is a partial by-passage of air. Physical signs were limitation of expansion, impaired percussion note, diminished breath sounds and coarse rales. In the case of a piece of bone in this same location, Dr. Stengel localized the bone by exaggerated harsh breath sounds having their maximum intensity posteriorly, corresponding to the endobronchial location, from which I subsequently removed the foreign body with the bronchoscope.

9. *This Tack, because of the Position of its Head, Completely Occludes the Bronchus.* Physical signs: Limitation of expansion; absence of breath sounds; flat percussion note; absence of rales on the invaded side; loud rales in great variety in the other lung. At 8 and 9 are shown different cases of the same kind of tack, of which nearly two dozen have come to the bronchoscopic clinic. In a number of these cases I have noticed at bronchoscopy the tack shifting from a position similar to that shown at 8 to a position similar to that shown at 9. It is logical to suppose that a similar shifting occurs to account for the changeability of the signs so

often noted in this kind of foreign body and, in fact, in almost all kinds of foreign bodies.

10. *A Tack in the Lower-lobe Bronchus, Embedded, because of its Prolonged Sojourn, in a Mass of Soft, Flabby Exuberant Granulations Which Are Partially Occluding the Orifice of the Middle-lobe Bronchus.* Before bronchoscopy, Dr. McCrae had noticed intermittently a diminution of breath sounds over the middle lobe. The natural inference is that there was intermittent and varying degrees of obstruction of the middle-lobe bronchus because of the location of the tack, the granulations and the pus at its orifice. The physical signs were: Limitation of expansion; a flat percussion note and absence of rales and breath sounds over the right lower lobe; a variety of rales and, intermittently, diminished breath sounds over the middle lobe; coarse rales at times in the other lung. In a number of similar cases a rib resection has been done under a mistaken diagnosis of empyema.

11. *A Peanut Kernel in the Right Bronchial Orifice, Almost Completely Occluding the Bronchus during Expiration Only.*

12. *The Same Patient as shown at 11. View a Moment Later at the Beginning of Inspiration.* The "forceps spaces" have opened up for the inspiratory by-passage of air, the exit of which is impeded by the collapse of the bronchial wall shown in the preceding illustration. This is the explanation, afforded by bronchoscopy, of the most important diagnostic phenomenon of obstructive emphysema, discovered by Iglauer and developed to a high degree of certainty by Dr. Manges.

MARCH 27

Roentgen-ray Diagnosis of Nonopaque Foreign Bodies in the Air Passages

BY WILLIS F. MANGES, M.D.

The roentgen-ray signs of nonopaque foreign bodies in the air passages depend upon the following conditions either alone or in combination:

1. Obstructive emphysema, monolateral or bilateral.
2. Retained secretions or drowned lung.
3. Abscess formation or septic pneumonitis.
4. Atelectasis in part of a lobe or perhaps one entire side.

The roentgen-ray signs of acute obstructive monolateral emphysema are:

1. Increased transparency of the affected lung.
2. Depression and partial fixation of the diaphragm on the affected side.
3. Displacement of the heart and mediastinal structures away from the affected side.

And we may add:

4. Increased excursion of the diaphragm on the unaffected side due to compensatory emphysema.

The diaphragmatic signs are the most important, for by them alone can one rule out compensatory emphysema.

In our former paper, sign No. 4 was suggested as "Increased density in the lung shadows on the opposite side due to detained secretions." We now feel that this is not sufficiently constant to be classed with those mentioned above. It does occur in a small percentage of cases and is present probably for the reason that the foreign body has shifted from one side to the other and caused an inflammatory reaction the products of which add to the density of the unobstructed lung, especially at expiration.

The above enumerated signs are present in proportion to the degree of expiratory obstruction. They may be so slight that repeated observations and exposures are necessary to establish them beyond doubt, or it may be necessary to make the child cry in order to record the changes that occur between full inspiration and full expiration. On the other hand they may be so pronounced that even at full inspiration the displacement of the diaphragm and mediastinal structures plainly indicate obstructive emphysema on the affected side. The most important point to remember is that the signs are accentuated most at the end of expiration—a point which was not made clear in our former report—and no examination is complete without instantaneous

roentgenograms at both full inspiration and at the end of expiration.

We have reasons to believe that these signs may be elicited very soon after the foreign body lodges. In F. B. 824 at the first examination no obstructive evidence was obtained—the foreign body being in the trachea—but on the second examination, within a few hours after the first, there was most positive evidence of obstructive emphysema of the left lung. The foreign body had in the meantime lodged in the left bronchus. In F. B. 838 the signs were present at the first observation and the foreign body had been present only one day. We believe, further, that the inflammatory reaction, especially edema, plays an important role in the mechanism of obstructive emphysema when the foreign body is of irregular shape, but that the signs may be elicited very promptly if the foreign body is of such shape that it will markedly obstruct the inspiratory current and almost completely obstruct the expiratory current.

Slight evidences of these signs are occasionally present for a period of hours after removal of the foreign body if the inflammatory reaction has been severe, but if they are at all striking or persist after twenty-four hours another foreign body must be assumed to be present until proven otherwise. In F. B. 884 the signs were present after removal of the first foreign body, became still more positive and remained so on subsequent days until a second fragment of peanut was removed. Following removal of this the child coughed up a third fragment on its way to the ward, after which the signs of obstructive emphysema disappeared entirely and the child promptly recovered.

We have noticed that the signs vary from day to day to some extent, but are strongly of the opinion that they will remain positive as long as the foreign body remains in the bronchus or until some change occurs distal to the foreign body to prevent further ingress of air. In Case 789 (peanut) there was a sojourn of nineteen days in a child two years of age; in Case 839 (watermelon seed) the signs were positive after a sojourn of three months;

and in Case 932 (peanut kernel) the signs were positive when the foreign body had been lodged in the right lower lobe bronchus forty-five days; but in this case, a man, aged fifty-six years, the upper lobe was not involved.

Obstructive emphysema may be present in an upper lobe with beginning abscess or increased density, due to retained secretions in the lower lobe, or one portion of a lobe, usually the dependent portion, may contain sufficient secretions to cast a quite positive shadow while the rest of the same lobe shows evidence of air distention. It requires very careful observation to elicit these combinations of signs.

We have never seen evidence of obstructive emphysema in an upper lobe with normal function and normal shadows in the lower lobe, but theoretically it might occur.

Retained secretions beyond the foreign body may collect in sufficient amount to produce a shadow of increased density in the dependent portion of the lung involved. This condition has been described by George C. Johnston as "drowned lung." It is more or less filmy in appearance, the bronchial shadows being visible. It is difficult sometimes to differentiate this from the early stage of actual abscess. In the later stages of abscess the shadow is much more dense, the bronchial detail is lost and the edges have a ragged appearance and more or less round shape. In the one case where the area is drained through the bronchoscope the products are mostly of a thick mucous character while in the other pus is clearly and bountifully obtained. After removal of the foreign body and bronchoscopic drainage of retained secretions the lung shadows approach the normal. In case of abscess there is the irregular density of tissues thickened by the infection. One rarely sees a cavity after such drainage but may later find evidence of bronchiectasis.

We know of no law controlling the collection of retained secretions in amount sufficient to cast a positive shadow unless it is one based entirely on the mechanics of the situation—that is, that the thick mucus and products of edema collect beyond

the foreign body and by force of gravity, together with the relatively strong current of inspired air, go to the dependent portion of the lung, where it is not influenced by the relatively weak current of expired air, the coughing effort or the physiologic expulsory functions.

Drowned lung shadows when definitely recognized are practically diagnostic of foreign body. This condition is frequently seen in metallic foreign-body cases and has the same appearance as in the organic foreign-body cases. On the other hand the absence of such a sign has no negative diagnostic value.

We know that these foreign bodies have a tendency to dislodge from time to time, and it is probable that each time the foreign body moves upward the secretions below are evacuated to some extent. Then, too, the lymphatics must take care of a considerable quantity. By referring to the analysis it will be seen that in F. B. 787 it was present in a peanut case of seventeen days, whereas in F. B. 839 a watermelon seed had been present three months and the lung shadows were clear. In this study roentgenographic signs of retained secretions were present in 6 cases and of abscess in 3 cases.

Abscess is necessarily the result of infection. It seems remarkable, considering the degree of inflammation and trauma, that infection does not follow more frequently. Of course such a result will eventually occur if the foreign body remains long enough regardless of the nature of the foreign body.

Atelectasis of the entire right lung was present in F. B. 900 (a bean lodged in the right bronchus only one day). The extreme displacement of the heart and mediastinal structures, as well as the diaphragm, could not be explained in any other way. This lung was expanded to almost its normal capacity within a few hours after the removal of the bean. In the case of F. B. 904 a portion of peanut kernel produced atelectasis of the left lower lobe and obstructive emphysema of the left upper lobe. In this instance the atelectatic lobe contained a considerable quantity of secretions, but the marked displacement of the heart toward

the affected side determines clearly the element of atelectasis, especially in view of the marked compensatory emphysema of the right lung.

It would seem probable that atelectasis follows only when the foreign body completely obstructs the bronchus both to ingress and egress of air, the residual air being more or less rapidly absorbed.

The signs of atelectasis are:

1. Displacement of the heart to the affected side.
2. Retraction upward of the diaphragm.
3. Marked density of the shadows in the area involved.
4. Compensatory emphysema of the unaffected lung.

It is necessary to determine that the patient has not previously had an empyema, since all of these signs may be present in certain of its stages. Atelectasis has been present in a few other of Dr. Jackson's cases, and in which the foreign body was also opaque. These are not included in the present analysis. When definitely proven to be present atelectasis is diagnostic of a foreign body as well as of its location. Compensatory emphysema is present in the other lung.

Tracheal foreign bodies may not give definite roentgen-ray signs, but when they are present are nearly as positive as the signs of bronchial intruders. Fortunately when they do not present the roentgen-ray signs they usually do present the most striking and positive physical signs.

Dr. Jackson says, "Any object small enough to pass the glottic chink yet too large to enter either main bronchus may be found." In the same treatise he also discusses the influence of shape and character of surface on the location of the object. Again, the mechanics of the situation determine the presence or absence of roentgen-ray signs. For instance a watermelon seed large enough to enter the trachea may be too large to enter a bronchus, and because of its flat shape may allow free passage of air both during inspiration and expiration, so that obstructive emphysema may be entirely absent. In 5 of the 9 cases of watermelon seeds

included in this study roentgen-ray signs were absent. However, in one of the 5 at a subsequent observation there was positive evidence of obstructive emphysema of the left lung (F. B. 824). The seed had become at least temporarily impacted in the left bronchus. Of the other 4 cases of watermelon seed, 3 showed signs of monolateral obstructive emphysema and 1 was not examined before removal.

On the other hand a tracheal foreign body that does not move freely, and because of its size and shape interferes with respiration to a considerable degree, will manifest the signs of obstructive emphysema of both lungs. The diaphragm is depressed on both sides and lower on expiration than on inspiration, being overcome by the more powerful intercostal muscles of respiration; the heart is more in the median line and more vertical, appearing in its entirety above the diaphragm. These signs will be very slight or quite positive according to the degree of obstruction. Occasionally they are distinguishable only by comparing roentgenograms made after removal with those made before removal. They are always more pronounced if the child struggles or cries, but it frequently occurs that the patient will breathe quietly with the utmost determination, for the reason that any violent expiratory effort is apt to force the foreign body upward against the glottis and produce an agonizing paroxysm.

We believe firmly that any organic foreign body lodged in the air passages will eventually cause death if not expelled or removed, and it is most dangerous to hope for spontaneous expulsion. On two occasions to our knowledge physicians have told the parents that the "peanut" would dissolve. This is an error as unfounded as it is dangerous.

The writer is deeply indebted to Dr. Jackson for his interest and encouragement as well as for his permission to use the material of his clinic in making this presentation.

Pentosuria: Report of Five Cases in One Family

BY HAROLD W. JONES, M.D.

AND

C. W. NISSLER, M.D.

The first case was reported by Salkowski and Jastrowitch in 1892. Since that time we have been able to find 49 cases in the medical literature. Three types are described, alimentary, complicating and essential.

The etiology is still in question, although Carl Neuber believes that it may arise from the galactose metabolism.

An excess of carbohydrates or the complete absence of them from the diet does not influence the excretion of pentose in the chronic or essential form.

The ingestion of d. galactose does not increase the output.

Both a levorotatory and dextrorotatory have been described.

A pentose is present in the urine in certain cases of pancreatitis. Pentose is fermented by B. coli Escherich and B. paratyphosis Schatt. Other sugars are fermented by specific bacteria and fungi. Pentoses reduce Fehling's, Benedict's and Nylander's solutions in a manner very similar to dextrose. With the phenylhydrazin test they yield a pentosazon. They do no ferment with yeast. They are commonly inactive to polarized light. Bial's test is the positive test for their presence. Clinically their importance lies in the liability to mistake them for dextrose because of the similarity of the reaction.

In December, 1920, a fourteen-year-old girl was brought to the Jefferson Hospital. She had taken cyanide by mistake. She recovered from this. The urine was positive for dextrose for nine days. The dextrose disappeared and pentose was found. In 61 examinations of urine dextrose was present in 9 and pentose in 50. The blood sugar was normal. The glucose tolerance test was normal. Starvation had no effect on the output. The renal function was normal. The urine of the other members of

the family were tested and pentose was found in Pearl aged five, Israel aged eleven, David aged thirteen and the grandmother aged sixty-eight. The diet of this family had nothing to do with the presence of pentose. One year later the examination of the urine still showed the presence of pentose. Clinically the girl first mentioned is of a very nervous type and shows evidences of a markedly unstable autonomic system. One very trying symptom is the presence of blue and greatly swollen hands. The feet are also involved. The cold makes the condition worse.

There are no cases on record in which so many members of one family have this condition.

The question arises as to whether or not the cases of renal glycosuria were not in reality pentosuria. All the cases are of the chronic or essential type.

We feel that it is better to call sugar in the urine by the type of sugar present as dextrosuria or pentosuria or levulosuria.

The most constant clinical feature is the presence of nervous phenomena.

This is a preliminary report, as we intend to study these cases further.

Soreness of the Tongue as an Initial Symptom of Pernicious Anemia

BY DAVID RIESMAN, M.D.

(*Abstract*)

Three cases of pernicious anemia were reported, in all of which soreness of the tongue was the first symptom. In two the soreness preceded the development of other symptoms by several years. Attention was called to the fact that while soreness of the tongue may be due to a variety of causes, in cases of obscure glossodynia the possibility of a latent pernicious anemia should be borne in mind.

DISCUSSION

Dr. Alfred Stengel: I think we ought to take notice of this presentation which Dr. Riesman has made, as of course it has a very important bearing, and I have had almost the same experience that he has had. I have very much in mind at this moment a patient who died in West Philadelphia a week or two ago. She was under my care in the University Hospital perhaps a year and a half ago; she was in a private room in the hospital for the study for nephritis; she had albumin and casts in her urine. She had a history of peculiar recurring attacks of diarrhea which was never explained fully, and among other things she had a sore tongue; blood tests did not show any change in the blood. She left the hospital and I heard nothing from her until about a year later I was called over to see her. She presented the appearance of pernicious anemia, and the blood picture showed that she had pernicious anemia. It was a very striking case and I have seen similarly striking cases, but there is something to be said on the other side of the question, and I hope you will not take it as a counter-current if I express it. A very eminent clinician, a well-known person, made a statement which I think ridiculous nonsense, "Glossodynia should always be associated with pernicious anemia." I think this is being carried too far. I have seen people who suffered from glossodynia who never had pernicious anemia. One case in particular, a patient of mine whose tongue I have looked at three or four hundred thousand times; whenever she sees me she sticks out her tongue and asks whether she has a cancer on it. She has had this for a period of ten to fifteen years, and I can recall other cases. Pernicious anemia does not always follow a sore tongue, but it is well to keep it in mind.

Dr. Schleif: I had a case of this nature. A gentleman, aged fifty years, presented himself at my office about eighteen months ago. He had a sore tongue; the condition cleared up and I did not see him until a few weeks ago, when he came back not feeling well. He took a vacation but returned in three weeks. The blood test showed 40 per cent hemoglobin with a leukocytosis of 1,500,000. A diagnosis of pernicious anemia was made and the ultimate development of the case proved this diagnosis to be correct.

Mycotic Aneurysms of Intravascular Origin

BY ALFRED STENGEL, M.D.

AND

C. C. WOLFERTH, M.D.

(*Abstract*)

Although arteries are apparently highly resistant to bacterial infection, they are attacked occasionally. The source of the infection is either extravascular or intravascular. In either case there may be such damage to the artery that aneurysm formation, rupture or both occur. Following the nomenclature of Osler and Eppinger the aneurysms arising in this way have been called "mycotic."

Four cases of mycotic aneurysms of intravascular origin have been observed during the past four years in the University Hospital and 209 cases were found in the literature. They occur most commonly in association with acute or subacute bacterial endocarditis, rarely rheumatic endocarditis. In many cases the bacteria are carried by emboli to their points of lodgment and there set up an inflammation of the artery that leads to the formation of aneurysm. Around the root and arch of the aorta and the pulmonary artery infection may be carried by continuity or contiguity from the aortic or pulmonary valves respectively. Bacteremia without endocarditis is occasionally the source of infection. The bacteria settle either on the inner surface of the vessel or in the vasa vasorum. The organisms found most often are streptococci. Pneumococci, influenza bacilli and staphylococci have each been found in several cases. The aneurysms occur at all ages but are most frequent in the first three decades (119 out of 182). The sex was stated in 178, of which 121 were males and 57 females.

Any artery may be involved and often multiple aneurysms are found. The favorite site is at bifurcations due to the fact that

emboli usually lodge there. The arteries most often attacked are the aorta, the abdominal visceral arteries especially the superior mesenteric and its branches and the smaller cerebral arteries. The vessels of the extremities are not exempt, and of these the brachial and the femoral are most often involved. Even in the largest arteries the aneurysms may be not more than 1 cm. in diameter and rarely exceed 3 or 4 cm. In the small cerebral vessels they may be so small as to be scarcely visible. They are very prone to rupture and false aneurysms are frequent. The mycotic process is usually sharply localized and the vascular apparatus elsewhere normal. If the infection is mild, attempts at repair ensue and the aneurysm may heal partially or completely. The aneurysmal sac may persist after healing or may disappear.

The histological pictures vary according to the stage and virulence of the inflammation. The intima and media are usually destroyed, although the outer part of the media may remain and form the floor of the aneurysm. The adventitia is usually damaged but may be completely destroyed and the wall of the aneurysm is then formed by the perivascular tissues. The elastic tissue is invariably badly damaged and the internal elastic lamina disintegrated. In the healed aneurysms the architecture of the vessel wall may be completely gone and the wall made up of fibrous tissue.

When the aneurysms involve superficial arteries their clinical diagnosis is usually easy, but in the deeper vessels their presence is rarely suspected before autopsy. Our Case 1 is the only one thus far in which a clinical diagnosis of mycotic aneurysm of the arch of the aorta was confirmed at autopsy. Rarely pulmonary, abdominal aortic and mesenteric mycotic aneurysms have been successfully diagnosed.

REPORT OF CASES

Case 1.—A. C., female, aged thirty-one years, was admitted to the University Hospital, May 2, 1920. Clinical diagnosis: Streptococcus viridans endocarditis, aortic and mitral regurgita-

tion; myocarditis with tremendous cardiac enlargement; subacute pericarditis; cardiac decompensation and passive congestion of the lungs, liver and kidneys; mycotic aneurysm of the ascending arch of the aorta; subacute nephritis; secondary anemia.

The diagnosis of mycotic aneurysm was based on the extraordinary degree and extent of visible and palpable pulsation to the right of the sternum in the second and third interspaces, associated with clear evidences of an aortic valve lesion, fever, leukocytosis and other evidences of an active infectious process.

At autopsy an aneurysm was found just above the right sinus of Valsalva. It was irregularly rounded and in the hardened specimen approximately 2 cm. in diameter and extended $1\frac{1}{4}$ cm. below the surface. The intimal surface adjacent to the aneurysm was ulcerated in places and vegetations were growing from it. There were also vegetations on the floor of the aneurysm. The wall of the sac was greatly thickened by overgrowth of fibrous tissue. It could not be determined whether infection of the artery had arisen by contiguity from the aortic valve or through the vasa vasorum.

Case 2.—J. B., negro, male, aged forty-nine years, was admitted to the University Hospital, November 4, 1921. The clinical diagnosis was streptococcal (nonhemolytic but not viridans) endocarditis, aortic regurgitation, cerebral embolism, subacute arthritis with effusion of the left knee-joint. He died, January 4, 1922. Examination of the thorax and abdomen only was permitted. An acute ulcerative and vegetative endocarditis of the aortic and mitral valves was found and a small aneurysm in the beginning portion of the arch about 1 cm. above the point of attachment of the anterior and right posterior aortic valves. The aneurysm was roughly 1 cm. in diameter and was pouched out about 0.5 cm. below the surface. The wall was greatly thinned but the inner surface had healed. Sections showed complete destruction of the internal elastic lamina. A few remnants of the media persisted. The adventitia was but little involved. The intima had been destroyed, but, according to Dr. Baldwin

Lucke, an endothelial layer coming from the intima at the edge of the aneurysm had completely covered over the floor. Dr. Lucke estimated the age of the aneurysm to be at least six weeks. It could not be determined whether infection had arisen through an embolus in the vasa vasorum or by settling of bacteria on the intima.

Case 3.—A. W., white, male, aged forty-four years, was admitted to the University Hospital, September 19, 1917. The clinical diagnosis was subacute infective endocarditis and mycotic aneurysm of the left femoral artery. The blood culture was negative but the diagnosis of infective endocarditis was based on a long-continued septic temperature course, irregularly recurring chills, signs of mitral endocarditis, enlarged spleen and petechial spots in the skin and red blood cells in the urine.

A few days after admission there was tenderness along the course of the left femoral vessels from Poupart's ligament halfway down the thigh. The tenderness persisted and in a few days slight swelling was noted. On October 20 there was a distinct localized mass just below Poupart's ligament with definite expansile pulsation. During the course of the next few weeks the mass gradually grew smaller and eventually disappeared entirely. The patient left the hospital, November 2, but was under observation until his death, four weeks later. No autopsy was made.

Case 4.—E. J., school-boy, aged eighteen years, was admitted to the University Hospital, September 10, 1921. When admitted he was in a state of severe cardiac decompensation but without evidences of infection. He had had rheumatic fever with cardiac involvement when he was five and a severe attack of long-continued fever with cardiac involvement again at the age of eight. Since the last attack his heart has always been weak and there have been many breaks in compensation. On examination he was found to have tremendous cardiac enlargement, with evidences of mitral valve disease, auricular fibrillation, marked passive congestion, edema of the legs and dependent portions of the body

and ascites. There was a tumor above the inner end of the right clavicle with violent expansile pulsation over it. There were no evidences of inflammation and the skin could be moved over it freely. The mass could be collapsed by firm pressure. The part of the tumor mass that could be seen and felt measured about 2 x 3 cm. The subclavian and carotid arteries appeared to emerge from it.

The diagnosis made was healed aneurysm of the innominate artery, which had probably developed during one of the previous infections. The patient and his family had been unaware of the presence of the aneurysm and consequently no information as to the time of its onset was available.

The patient remained in the hospital ten days and died ten days later. No autopsy was made.

DISCUSSION

Dr. Stroud: I would like to add two cases which I have seen in the last two years to the series which Dr. Wolferth has mentioned. One of these illustrates some of the points which Dr. Wolferth brought out very closely. The aneurysm was in the brachial artery just at the elbow; it was very easy to diagnosticate and was associated with acute bacterial endocarditis.

The second was in the service of Dr. Norris, at the Pennsylvania Hospital; the patient died a few months ago following an operation by Dr. Gibbon. This case was in a young Indian girl who was a graduate of Carlisle. She had an aneurysm of the femoral artery accompanied by a subacute endocarditis. Dr. Gibbon was called in consultation and he hoped to relieve the pain by an operation. Dr. Norris had explained to the girl the dangers of an operation, but she wanted to be relieved of the pain. The operation was very successful; she lived for two or three weeks and was relieved of the pain. But finally she died very suddenly one night. There were no emboli in the brain and the cause of death was not ascertained.

Dr. Stengel: I would like to say one word about the question of operation, although perhaps it is not in my domain. The question came up very clearly in a patient of mine, a man of enormous physique, six feet four to six inches—one of the biggest men I have ever known. He was in relatively good condition when an aneurysm developed. It got up to quite a good size and we were afraid it would rupture, and

wondered what we were going to do about it. Dr. Deaver confirmed the diagnosis and was prepared to do an operation in case the thing ruptured, but it seemed to recede and finally disappeared altogether—at least it had so nearly disappeared (as I remember it) we could not feel it. He lived for a month to six weeks afterward. Of course an operation in these cases is not to be thought of except in extreme measures to prevent a catastrophe.

Dr. George Norris: The operation in the Indian girl from Carlisle was done to relieve the intense pain. She said she was willing to have the leg taken off if necessary to stop the pain. The operation apparently did not cause death, as she lived twenty-two days after the operation, and seemed to be doing very well.

Dr. Wolferth: There is just one point that I would like to make: These aneurysms are more common in subacute bacterial endocarditis. I went over a recent series of subacute infectious endocarditis and we were not able to find a series of any size in which one or more of these cases were not found, and in many series three or four cases.

The Influence of Oliguria on Nitrogen Retention in the Blood

BY O. H. PERRY PEPPER, M.D.

(*Abstract*)

The presentation consists of a review of our knowledge concerning the influence of oliguria on nitrogen retention in the blood. It has been shown that the normal kidney under special conditions can excrete urine containing urea up to a concentration of 5.6 per cent. As a rule, under normal conditions the concentration of urea in the urine varies between 2 and 4 per cent. It is obvious, therefore, that for the excretion of 30 gm. of urea, which is the usual twenty-four-hour production, more than 500 cc of urine is required. Assuming that the urea production remains constant and that no compensatory excretion of urea occurs through the skin or bowel, any reduction of the urine below about 500 cc will result in some retention in the blood. This fact has not been adequately taken into account in the

analysis of clinical cases in experimental nephritis in the application of the urea concentration test of kidney function or in the treatment of nephritis. The occurrence of nitrogen retention in the blood has led certain observers to assume that a true interference with the nitrogen excreting function of the kidney was present, when in fact the retention could be explained on diminished urine production. Conclusions based on data not including the urea concentration of the urine must often be fallacious, and this determination as well as the estimation of the twenty-four-hour urine output should be more routinely performed and will give help both in diagnosis and treatment.

DISCUSSION

Dr. Edmonds: I think the point that Dr. Pepper has brought out in respect to the amount of water elimination in accounting for an increase of urea in the blood is an extremely important one. The work of Ambard in leading us to think of the relation between blood nitrogen and concentration of urea as an equilibrium is a definite step forward; unless we treat blood nitrogen alone or excretion of urea alone we have nothing definite with which to compare our findings. Wherever that has been done false conclusions have not entirely been drawn. Recently in the literature there have been conclusions drawn where the rise of blood urea shows high nitrogen content. The recognition of Lintz in consideration of this equilibrium, taking into consideration the effects of water drunk and the rate of urea excretion, came to the conclusion that diuresis had no effect between the concentration of urea in the blood and the rate of excretion in the urine.

Dr. Weiss: I must admit that Dr. Pepper's criticism in regard to urea concentration tests, on which I have been working for a couple of years, is a just one. I have never measured a twenty-four-hour output but have confined my tests to two-hour specimens. I have never observed any relationship between the concentration of urea and the amount of urine excreted. The urea content in 35 cc of urine might be very high in case of disease, and the same with a large quantity of urine; in 150 cc the concentration of urea might be high. As Dr. Pepper mentions, the relation between urea concentration and the amount of urine excreted is an important one. I thank Dr. Pepper for his criticism.

Dr. David Riesman: There is one point I wish to mention in connection with Dr. Pepper's paper, and that is whether we do not some-

times act unwisely in sweating out patients—whether we do not in some cases increase the concentration of urea thereby to a harmful degree. I should like to know Dr. Pepper's view. It is easy to see that sweating might take away unnecessary water. Another point I would like to know about: Whether or not the concentration of urea does not act as a diuretic?

Dr. Pepper: As far as urea acting as a diuretic is concerned I think in normal individuals it does serve in some cases as a diuretic, but in others it has no effect on diuresis. There is never over 20 mg. of nitrogen in the blood normally, and when urea causes increase in the blood nitrogen we would think perhaps it would cause an effort on the part of the kidney to bring about a normal condition; but clinical results do not bear out this belief. In many cases where we have an excess of urea, as we have seen in our urine analyses at the Jefferson Hospital, the urinary output is not increased; in fact the blood urea tends to increase, and it is then that oliguria results. In reply to Dr. Weiss, I did not mean my remarks as a criticism and I do not want to accept thanks for something I did not give. I merely cited one of Dr. Weiss's cases to point out why we should not draw conclusions without taking into consideration the amount of urine excreted in twenty-four hours. I was not making any criticism of his test.

In regard to Dr. Riesman sweating "dry" cases, I agree with him that we should supply all the water we get out when we sweat the patients by giving them more, either by mouth, by rectum or intravenously.

APRIL 24

A Case of Chronic Glomerular Nephritis Complicated by Hemopericardium

BY C. A. HEIKEN, M.D.

AND

J. F. EDMONDS, M.D.

Case History.—S. K., aged twenty-six years, white, male. Admitted, November 16, 1921. Died, December 15, 1921.

Chief Complaint. Pain in the stomach, vomiting and spitting of blood.

Hospital Personal Inspection. Began five months ago with severe frontal headache followed one week later with epigastric pain several hours after eating; the attacks were intermittent all summer; he felt perfectly healthy during the intervals. He gives a history of jaundice on several occasions and has had some edema of the feet at night and nocturia three or four times for the past few years; hemoptysis for the past few months; no history of night-sweats, but has lost forty pounds.

Previous Medical History. Had influenza three years ago.

Family History. Father died at the age of fifty-six with kidney trouble.

Physical Examination. A fairly well-nourished white male.

Eyes. Lower lids and cheek edematous.

Chest. Musical and crackling rales throughout.

Heart. A soft systolic murmur at the apex, otherwise normal.

Arteries. Pulse strong and bounding; blood-pressure, 180/135.

Abdomen. Liver dulness three fingers below costal margin; some gall-bladder tenderness.

Extremities. No edema.

Bedside Notes. November 21. Complains of sharp substernal pain; no friction heard.

November 23. Complains of severe precardial pain; to-and-fro pericardial rub heard; patient apparently on the verge of coma.

December 1. Breath very offensive; skin, buckwheat cake in character; pulse small; pericardial friction less pronounced at present; lungs clear.

December 3. Beginning edema of feet; patient stuporous.

December 5. Pericardial friction absent.

December 12. Crackling noise over the body of the heart with a palpable thrill; heart area much enlarged; pericardial effusion.

December 14. Patient stuporous, growing weaker; pericardial friction heard again; blood-pressure, 160/95.

Laboratory Findings. Urine. Average findings: Specific gravity, 1020; sugar negative; albumin a cloud.

Microscopic. Granular casts and leukocytes.

Renal Function. Phthalein output 0 after two hours on repeated examinations.

Blood Chemistry:

	Highest.	Lowest.	
Urea	327 mg.	126 mg.	Per. 100 cc
Creatinin	30 mg.	7 mg.	" "
Sugar	200 mg.	170 mg.	" "
Uric acid	12½ mg.	8½ mg.	" "
Chlorides	535 mg.	337 mg.	" "
Plasma, CO_2	40 mg.	25 mg.	Vol. per cent.

Blood Count. Red blood cells, 2,480,000; white blood cells, 24,000; polynuclears, 89; lymphocytes, 9; mononuclears, 2.

Eye-ground Examination. Flame-shaped hemorrhages in the retina; arteries sclerosed.

Postmortem Findings. Abdomen. 700 cc of fluid.

Thorax. 400 cc of fluid in each cavity.

Pericardium. 1400 cc of dark red fluid; fibrinous exudate on the visceral layer near the apex.

Heart. Weight, 555 gm.; hypertrophy of the right and the left ventricles.

Kidneys. Small and contracted.

Histological Diagnoses. Heart: Epicarditis; hypertrophy; arteriosclerosis.

Kidneys: Chronic glomerular nephritis; chronic interstitial nephritis; acute tubular nephritis; arteriosclerosis.

DISCUSSION

Dr. Herman B. Allyn: I recall a case somewhat like this one in my service at Blockley a number of years ago. A man entered complaining of blindness only, a blindness which was due to the effects of interstitial nephritis. On examination he was found to have a very large pericardial effusion. When aspirated it was so bloody I feared I must have punctured the heart, and was very much disturbed. Forty-nine ounces of fluid were drawn from the periderm.

Dr. O. H. Perry Pepper: In Dr. Riesman's absence it might be well to mention an article which he published about fifteen years ago in the *Journal of the American Medical Association* on "Hemorrhagic

Diathesis or Interpericardial Bright's Disease." Hemorrhagic phenomena are not unusual in these pericardial stages of nephritis. In that paper Dr. Riesman was not referring to hemorrhages of the lungs, vagina, mouth or gums but to those cases in which bleeding occurs from all the mucous membranes, and which in the skin purpuric spots appear, and gives statistics of the frequency in the literature in which these different hemorrhages occur. He also mentions in this paper the occurrence of hemorrhagic phenomena in the serous cavities. In these patients hemoptysis occurs and later bleeding from the mouth and hemorrhages in the pericardium.

I would like to ask whether any purpura in the skin was observed or whether or not melena, which is a very frequent phenomena in these pericardial stages, was observed. The hemorrhagic phenomena is always in the cases that get high blood urea or nitrogen retention.

Dr. Beardsley: We have a young medical man in a private room in the Jefferson Hospital, at the present time, who came in with very much the same history that Dr. Allyn mentioned—failing vision. When he was a student he had signs of exophthalmic goiter, and we have been wondering whether the exophthalmic goiter could have brought about in the course of six years the condition of interstitial nephritis. He has a blood-pressure of 300. When he was a student he was known to have a slightly high blood-pressure and was advised by surgeons to have an operation for removal of a toxic goiter, but he refused to do this, and failing to observe that he was getting distinctly worse from year to year, until now it is too late to relieve him. He has been in the hospital only ten days, but his progress downward has been most rapid.

It would be interesting, from a clinical standpoint, to learn, if we can, how to prevent these cases. It seems tragic for a young man only thirty-two years of age to have to be taken away with a condition that we could perhaps prevent.

Dr. Heiken: The patient I mentioned was rather unintelligent and did not seem to have any knowledge about himself at all. As a matter of fact, he could not give any satisfactory history of his present trouble. The only factor we have in the case was that he had one parent who died of Bright's disease, if one chooses to accept a congenital idea of the case.

In a recent article in the *American Journal of the Medical Sciences* the author states that most of these cases are found in adult life up to about forty years of age, although he mentions one case of fifty-six years, but as far as etiology of the condition is known it is more or less in the dark.

Our patient has not been able to help us out at all. There is no purpura in this patient and no evidence of melena. The blood platements were not counted.

Some Cardiac Studies in Pregnancy, with Special Reference to the Electrical Axis of the Heart

BY TRUMAN G. SCHNABEL, M.D.

Sixteen cases of pregnancy were studied both before and after delivery. Physical examinations and electrical cardiographic studies were made of the heart. The cardiac rate was slightly elevated in all cases, but never more than twelve beats.

The blood-pressure readings were slightly higher during pregnancy in all cases except two cases. No case had a higher systolic reading than 125 mm. Most cases were 110 mm. or less.

The cardiac area was outside of the midclavicular line in 2 cases. In 1 case it seemed to move inside after pregnancy. In 3 cases the cardiac impulse was in the fourth interspace both before and after delivery. Systolic murmurs at various valve areas disappeared in 4 cases and appeared in 1 case after delivery.

Electrocardiography showed no unusual changes in the spread of the excitation wave during pregnancy. In 6 cases the electrical axis had shifted toward the left for more than 12 degrees. In 1 case there was a swing of 46 degrees thirteen days before, and in 1 case, three days before delivery, there appeared to be a shift of 7 degrees to the right.

DISCUSSION

Dr. S. Calvin Smith: Not knowing that Dr. Schnabel was investigating the subject which forms the basis of his most interesting paper, I was also making observations which include the subject at the Medico-Chirurgical Hospital last summer and fall. It is gratifying to know that each of us, working independently, arrived at virtually the same conclusions.

The electrical axis of the heart is that axis upon which the greatest potential difference is manifest at any given instant of time.

While it is true that the electrical axis and the anatomical axis of the heart do not necessarily coincide, they bear a sufficiently constant relation to each other to enable us to form an electrocardiographic estimate of the position of the heart in the chest. Changes in the electrical axis are recorded by the electrocardiograph, and it may be expected that enlargement of the heart's chambers, which cause change in the anatomical axis, will be recorded in the graphic record. Therefore, electrocardiographic evidence of heart enlargement should be of value, when considered in connection with physical signs, in helping one to arrive at clinical proof of heart increase.

At the commencement of my studies the clinical observations and the first few written records seemed to confirm the rather general opinion that the heart enlarges during pregnancy. Examination of the expectant mother in the sitting position quite constantly showed that the left border of the heart was farther to the left than one would ordinarily expect to find, and the point of maximum intensity was greater by 4 or 5 cm. than the customary distance of that point from the midsternal line; the right border of the heart in such patients could not be determined by percussion, probably for the reason that the right border was under the sternum; furthermore, the electrocardiograms of such patients show some degree of inversion of the Q-R-S group in Lead III, thus indicating that the left ventricle predominated. Such evidences of apparent heart enlargement could be found at any period between the fifth and ninth months of pregnancy, but were not observed before the fifth month. The enlargement, however, was more apparent than real, for when the expectant mother was examined in the standing position the left heart border (in those women who were free from other evidences of circulatory fault) usually returned to its customary position in the chest, as did also the point of maximum intensity. Examination when recumbent did not produce as marked a change in the left border as was produced by standing, the palpable reason being that it is customary for the heart to shift to the left in many persons during recumbency. The apparent "hypertrophy" of the heart when sitting could therefore be attributed to postural shift, occasioned by pressure of the gravid uterus and abdominal contents from below.

The records of a patient who had evidences of heart enlargement when sitting or lying, but who did not have such records when standing, show that, as the baby descended into the pelvis during the first stage of labor, the graphic evidence of heart enlargement became less pronounced, and promptly after the birth of the child the records gave no evidence whatever of heart enlargement. Again, if pregnancy in itself

were a cause of heart enlargement then certainly enlargement would be manifest in a mother who had carried many children. The roentgen-ray studies and electrocardiograms of a mother taken toward the close of her eleventh full-term pregnancy were normal. Observations such as these lead to the conclusion that pregnancy, *per se*, is not a cause of cardiac enlargement.

A Study of Urinary Output and Blood-pressure Changes Resulting in Experimental Ascites[1]

BY J. MONROE THORINGTON, M.D.

AND

CARL F. SCHMIDT, M.D.

A CLINICAL case presenting ascites and decreasing urinary output is reported. Examination of the urinary tract was at all times negative and, following laparotomy with removal of the ascitic collection, the urinary function resumed its normal course. The pathology revealed by operation was an omental carcinoma, but the kidneys were normal.

To explain the diminished urinary output in this case a series of experiments were performed in dogs in which intra-abdominal tension was raised by injecting fluid into the peritoneal cavity, the urinary output being measured at varying degrees of intra-abdominal pressure.

It was found that a rise of intra-abdominal pressure to 30 mm. (mercury) is uniformly followed by complete suppression of the urine; pressures lower than 15 have no constant effect; pressures of 15 to 30 cause progressive diminution of output.

Venous pressure within the inferior caval system below the diaphragm rises with intra-abdominal pressure, the resulting effect upon the renal circulation being comparable to that of partial occlusion of the renal veins.

As intra-abdominal pressure rises there is a slight but persistent lowering of the general arterial pressure.

[1] From the Presbyterian Hospital, Philadelphia, and the Department of Pharmacology, University of Pennsylvania.

When fluid is gradually introduced the abdominal muscles lose their tonus and much more fluid can be accommodated without pressure symptoms.

DISCUSSION

Dr. Wood: There is one point I would like to ask Dr. Thorington, and that is how he explains that the suppression of urine is due to stoppage of the venous outflow through the kidneys.

Dr. Pepper: I would like to ask Dr. Thorington whether the foreign injection in the patient was intravenous or intramuscular?

Dr. Norris: I was personally very much interested in this paper. It seems to me to be a very excellent piece of work and throws light on a subject that we are all familiar with from a clinical standpoint, but regarding which there has never been any very definite knowledge, so far as I am informed.

From a clinical standpoint the large increase of urine most of us have been inclined to explain in these cases is due to relief of pressure on the kidney, either on the kidney itself or on the venous supply.

Dr. Thorington: In answer to Dr. Wood, since the venous pressure is decreasing as the diaphragm is approached, it follows that the influence of external pressure upon the inferior caval system is exerted on the renal veins. When we raise the abdominal pressure to 30 mm. it gives us a constant figure or an equilibrium between the abdominal and venous pressure. A variation of 2 mm. will allow the urine to go through at regular intervals.

In answer to Dr. Pepper, the injection was intramuscular.

OCTOBER 23

Third International Congress on the History of Medicine

BY E. B. KRUMBHAAR, M.D.

The Third International Congress on the History of Medicine was held successfully in London, July 17 to 22, under the honorary

presidency of Sir Norman Moore and the acting presidency of Dr. Charles Singer, two of the leading medical historians of the English-speaking world. Distinguished representatives from practically every country of Europe, except Germany, Austria, Russia and one or two of the Balkan States, attended the scientific meetings at the Royal Society of Medicine. In addition, interesting visits were paid to the Royal College of Physicians, the Lord Mayor's Mansion House, the Royal College of Surgeons, the Barbers' Hall, the Apothecaries' Hall, the Wellcome Historical Museum, St. Bartholomew's Hospital (which has just celebrated its 700th anniversary) and similar sites of historic importance. The receptions at the two guild halls were of especial interest, as they are seldom open to visitors. At the Barbers' Hall, a charming oak-wainscoted Jacobean structure built into the old London wall, the master and members, clothed in their furred robes and chains, told its history since the foundation by Henry VIII and exhibited the priceless plate and portraits by Holbein (Henry VIII granting the charter), Lily, Van Dyck, Reynolds and others. An incident showing its power in former times was the reprimanding of Harvey, a member of the Company, for "indifferent practice." The larger Apothecaries' Hall presented a still greater collection of important historical relics and portraits, including one by Sir Joshua Reynolds of a bearded John Hunter that has never been reproduced. Among other eminent men connected with this "society" were Ashmole, Cheselden, Cullen, Davy, Fothergill, Garrod, Goldsmith ("plucked" at the College of Surgeons), William Hunter, Jenner, Keats, Parkinson, Smollett, Sydenham and Wells. Its present as well as its past importance finds one indication in its continuance of the right of licensure to practise medicine in Great Britain. At the Royal College of Physicians, its president, Sir Humphrey Rolleston, gave a most entertaining discourse on the history of the institution, and their splendid historical library and portrait gallery of distinguished members were exhibited.

The scientific program was chiefly devoted to medieval epidemics and to the history of anatomy. In the former topic important

papers were given by Tricot Royer, a former president of the association, Prof. Simpson, Wickersheimer, Mrs. Singer and others. The subjects of the anatomical papers, too numerous to mention, ranged from such general topics as "Beginnings of Western Anatomy," "Early Anatomic Instruction in Edinburgh," "Beginnings of Anatomical Teaching in the United States," through individual consideration of Galen, Leonardo da Vinci, Vesalius and Descartes to a valuable group of papers on veterinary anatomy.

The International Society of the History of Medicine was founded at Paris in 1921, with the object of studying all subjects pertaining to the history of biological and medical sciences and of organizing Congresses of medical history. Three such Congresses have already been held, and henceforth will be held triennially, the next being at Brussels in 1925. At this year's Congress, Great Britain was well represented by Sir Norman Moore, Sir d'Arcy Power, Dr. and Mrs. Charles Singer, Sir James Purves Stewart, E. T. Withington, W. Wright, F. J. Poyton, W. G. Spencer, J. D. Comrie. C. J. S. Thompson, Major-General Sir F. Smith and others; France by Laignel-Levastine, Fosseyeux, Villaret, Jeanselme, Wickersheimer and others (Menetrier, unfortunately, could not attend). Capparoni and Castiglioni from Italy, Tricot Royer from Belgium, de Lint from Holland, Sigerist (unofficially) from Switzerland and representatives from Czecho-Slovakia, Denmark, Egypt, Greece, Portugal, Roumania and Spain were also present. The United States was represented by Drs. B. I. Hart, of Bridgeport, Conn.; E. B. Krumbhaar, of Philadelphia, and V. Robinson, of New York. Dr. Fielding H. Garrison, the official delegate, was compelled to be absent, having been ordered to the Philippines. It is hoped that before the next Congress a National Section (as called for in the Regulations of the International Society) will be organized and firmly established in this country.

A Clinical Pathological Classification of the Lymphadenopathies

BY HERBERT FOX, M.D.
AND
DAVID L. FARLEY, M.D.

This presentation is intended to show a classification of the enlargement of lymph nodes on the basis of the participation of each of the anatomical-histological elements of lymphatic tissue. These elements are lymph cells, endothelia, reticular and fibrous tissue and adventitious cells deposited by the blood stream. Hyperplasia of each of these elements can be orderly or restrained, disorderly or unrestrained; it can occur within the node or pass through the capsule. Hyperplasia of these elements can be pure, that is, affecting one of them, or it can be compound. Such theoretical changes actually fall into groups which correspond to the principal clinical groups. These latter are reduced to fifteen representative types, between which there are gradations. This applies principally to the lesions known as pseudoleukemia or aleukemia, lymphosarcoma and reticulum sarcoma. Analysis of the clinical feature of the fifteen types does not permit a definite diagnosis beyond a certain point. It is necessary to add gross and microscopical pathology. The former of these can be obtained in part by roentgen-ray examinations and operation, the second by diagnostic adenectomy.

The Boundaries of General Practice

BY J. T. ULLOM, M.D.

The field of medicine is so broad that it is impractical for one individual to do all the things in medicine and surgery. It is possible and was formerly done to a large extent by the practitioners

of a few decades ago, but with the tremendous development in surgery and the great advances in medicine, together with the multiplication of laboratory tests, we find that the interests of society are best conserved by a division of labor, and we have the development of specialists.

The development of a specialist is, however, a long and expensive procedure, consequently there must be an adequate return on the investment. This makes the employment of specialists entirely, while splendid in theory, impractical for people in moderate circumstances.

An attempt has been made to popularize the practice of medicine entirely by specialists. We have the "Group," which flourishes particularly in the West, and we often see in the large cities rich families who have no family physician, but depend upon the various specialists alone. But in all such combinations a correlative agency is desirable, and such an agent must be a physician with a great breadth of knowledge and wide understanding. Such an individual is usually an internist or a general practitioner of a high type. Whatever the future of practice may be, whether we shall see an attempt made to develop group practice more extensively or some entirely different scheme, it is difficult to see how we can get entirely away from the family physician. Group practice may flourish in the cities and towns of moderate size, but in the rural communities and smaller towns the general practitioner must be the medical integer.

Now the question arises as to what he should undertake and what he should refer to others. The answer to that question depends much upon the general practitioner—his training, his age and his experience. No set rule can be formulated.

In an effort to clarify the answer to this question it would seem not inappropriate to examine in detail the work of a practitioner in the suburbs of a city, hoping that such a survey might stimulate some discussion and help to decide just where the boundaries of general practice should be. So the work of one year has been taken as a basis. In this analysis the classification used in textbooks on the practice of medicine has been followed:

1. The Infectious Diseases. It shows 2 cases of typhoid fever, 5 of lobar pneumonia, 15 of scarlet fever, 3 of diphtheria, 14 of tuberculosis of the lungs, 1 of tuberculous meningitis, 18 of influenza, 2 of pertussis, 2 of mumps, 3 of syphilis, 3 of gonorrhea, 3 of erysipelas, and 3 of focal infection.

It is, of course, evident that this group may differ very much from year to year. Typhoid is now a rare disease in the city and an epidemic is very rare. Influenza, of course, varies. The year analyzed was 1921, when our recent epidemic was on the wane. Measles was not seen in this year, because in 1920 there was an epidemic in this community, and all nonimmunes contracted it. Scarlet fever and diphtheria are endemic in a large city, with occasional outbreaks amounting to an epidemic.

2. Intoxications. In this group only 2 were seen, both alcoholics.

3. Diseases of Metabolism. In this group 4 cases appeared, all diabetes.

4. The Digestive System. Forty-five cases of tonsillitis, 2 of gastric ulcer, 1 of gastric cancer, 3 of achylia gastrica, 2 of pyloric stenosis in infancy, 1 of acute catarrhal jaundice, 1 of cancer of the liver, 3 of cholecystitis, 5 of appendicitis, 1 of cancer of the cecum, 5 cases of constipation, 11 of diarrhea, 2 of fistula-in-ano and 1 of ischiorectal abscess.

5. The Respiratory Group. Here we have 66 cases of acute coryza, 2 of acute catarrhal laryngitis (1 so severe as to require intubation), 24 cases of acute bronchitis, 3 of chronic bronchitis, 1 of pyopneumothorax, 2 of bronchial asthma, 1 of broncho-pneumonia, 3 of hayfever.

6. The Circulatory Group. Two cases of acute endocarditis, 1 of subacute endocarditis, 6 of chronic endocarditis (4 of mitral disease and 2 of aortic). Fifteen cases of chronic myocarditis, 2 of angina pectoris, 35 of hypertension, 1 of congenital heart disease, 2 of embolism (1 cerebral and 1 pulmonary).

7. The Urinary Tract. Eight cases of pyelitis, 3 in adults, 5 in children, 3 of nephrolithiasis, 7 of chronic nephritis, 1 of acute cystitis, 1 of chronic cystitis, 1 of hypertrophied prostate.

8. Blood-making Organs. One case of Hodgkin's disease, 6 of secondary anemia of undetermined origin. They were all women and all had painstaking examinations without revealing the cause of their trouble.

9. Diseases of the Bones and Joints. One case of acute osteomyelitis, 2 of acute traumatic synovitis, 6 of arthritis, 2 of arthritis deformans, 2 of sacroiliac sprain, 3 of myositis, 3 of painful back of undetermined origin and 1 of metatarsalgia.

10. Diseases of the Ductless Glands. Here we have 4 cases of goiter.

11. Diseases of the Nervous System. Five cases of apoplexy, 1 of paralysis agitans, 2 of herpes zoster, 2 of epilepsy, 5 of menopause, 2 of insanity, 1 of angioneurotic edema, 5 of neurasthenia. (The diagnosis of neurasthenia is a dangerous one, but all these patients had been under observation for years, had been carefully studied from various angles and had never shown any real disease.)

12. Diseases of the Ear. During the year under consideration there were treated 10 cases of acute otitis media, 3 of chronic otitis media and 1 patient was referred for a mastoid operation. A number of patients were treated for impacted cerumen.

13. Pediatrics. All the cases of scarlet fever, diphtheria, chicken-pox, mumps and pertussis seen were among children. Tonsillitis, colds, bronchitis and pyelitis are found more frequently among children than among adults. Twenty infants were artificially fed during the year and two infants suffering from pyloric stenosis were treated. One child with acute osteomyelitis was seen in consultation and one infant was born with a sarcoma in the axilla.

14. Surgery. Here the work done by the family physician is generally minor. In the year under consideration there were treated 13 boils, 2 carbuncles, 5 infected fingers, 3 infected feet, 2 sebaceous cysts, 3 injuries to the hand. There were done 3 circumcisions, 3 paracentesis abdominis, 5 paracentesis thoracis, 1 removal of wen and 1 abscess of the breast. There were 6 sprained ankles, 1 intracapsular fracture of the femur, 1 of the

surgical neck of the humerus, 1 of the finger, 1 of the base of the skull, 1 subcoracoid dislocation of the humerus and 1 of the acromion. Three inguinal hernias, 1 varicose ulcer and 1 case of varicose vein were seen. There were referred 3 appendectomies, 1 cholecystectomy, 1 ischiorectal abscess, 1 foreign body in the knee, 1 tumor of the breast, 8 tonsillectomies and 1 mastoid operation.

15. Obstetrics. Thirty-two maternity cases were attended and 8 miscarriages, 2 requiring curettage. In the maternity work forceps were used three times, version once and there was 1 breech birth. One hydrocephalic child was delivered without difficulty and 1 woman was delivered who had a severe mitral stenosis. Three patients had mild toxemia of pregnancy and 2 were referred for Cesarean section.

16. Gynecology. Two cases of acute gonorrheal salpingitis, 1 of chronic gonorrheal salpingitis, 2 of carcinoma of the ovary and 2 with partial prolapse were fitted with pessaries. Four patients were referred for plastic operations, 2 for the application of radium and 3 for hysterectomy for fibroid.

From a survey of the foregoing it is quite evident that the major part of a general practitioner's work is medical, assuming, as I think is justifiable, that there is not much variation in different communities. He treats, with occasional consultations in difficult cases, all the work ordinarily classed as medical. He does minor surgery, including simple fractures. He does obstetrics with the exception of Cesarean section and nonoperative gynecology. He treats all medical cases among children and superintends their feeding and care. He refers all general and gynecologic surgery, all refractive and ophthalmoscopic work, all special surgery and roentgen-ray work. Laboratory work is done by an assistant.

General practice, as will be seen from this summary, has many features to attract and some to repel. A great deal depends upon the temperament of the individual. To some the long hours and consequent lack of opportunity for study and recreation, the petty annoyances and the trivialities complained of are great

deterrents. To others the great breadth of the field and the wide variation in the things seen and studied are decided attractions. Everyone likes to do the things that he does well, and specialism offers an opportunity for the acquisition of great skill. But in general practice, by close application and the utilization of every opportunity, one may acquire great skill in physical examination and diagnosis. The field is there and can be cultivated.

The position of the general practitioner in the home is a great attraction to many men. The physician is the most intimate friend of the family and is in closer touch with the domestic circle than any outsider. The respect which is his more than counterbalances the petty annoyances to which he is subject. In many communities he is the most influential and important man to be found. Much has been written of the disappearance of the family physician. He has not disappeared but has changed. The practitioner of the previous generation, with his scanty training, his careless examinations and inexact methods, is passing, and in his place we have the man of broad training who will practise medicine in a much more exact and scientific way, and who will, we hope, serve his fellows better than in the past.

The question naturally arises as to the training of the medical student expecting to enter general practice. He should have, of course, the best general and professional education possible.

Then he should have one year at least in a general hospital, with especial attention to the medical, obstetrical and children's wards, and to the laboratory. Surgery he should attend to but not as assiduously as to the others. If he is to practise in an isolated community he should know surgery better than if he is to practise in a city, for he may be obliged to do considerable of it; but in the large cities it is better to leave it to men who are especially trained for such work.

In many cities and towns of this country we see men who are engaged in general practice who are striving to become specialists. This is a laudable ambition and should be encouraged. Many individuals realize what they wish to make their lifework only after some experience in practice. With the development of

postgraduate schools it is now quite possible for such men to perfect themselves to their chosen field. With the additional training they become more useful to their communities and bring to the door of their patients a service that formerly required a visit to the metropolis. Their experience in general practice is of distinct advantage and gives them a much greater breadth of vision.

The postgraduate training of a man devoting himself purely to general practice should be along the lines of internal medicine, obstetrics, pediatrics and the laboratory. It is here that his widest field of usefulness exists, and he should strive to become as proficient as possible in these subjects. Occasional visits to large medical centers, with courses pursued in these branches, will keep him abreast of the times, stimulate him and renew his enthusiasm. His work may be less dramatic than that of some of his professional brethren, but if it is well and efficiently done, he has the enduring satisfaction of being of great use in the world and of rendering a service that his community could hardly do without.

DISCUSSION

Dr. J. M. Anders: The paper of Dr. Ullom is one of great practical interest and importance. The general practitioner occupies an important field, which should be made as attractive and profitable as possible. Unfortunately, his domain has become more and more narrowed. The rapid elevation of the medical educational standards, including a decided lengthening of the course of preparation for medical practice, as well as the increased cost and later graduation, are all factors combining to lead the recent graduate to seek more promising fields; he accordingly takes up a specialty at an early stage of his career.

Again, many recent graduates are being pressed into public pay positions, *e. g.*, in the departments of public health, public welfare and public instruction, as well as the various industries. Now, both the specialists and the men holding public positions with pay rob the general practitioner of a certain amount of work which he formerly performed. Moreover, the general practitioner, more particularly in rural districts and the smaller communities, who has been out of touch with modern methods and a well-equipped laboratory, has found himself retrograding.

In view of these considerations there has come about a scarcity of practitioners in proportion to the general population and lacking in equipment, so that a service unsatisfactory to himself and the public alike has been rendered by him.

On the other hand, it is possible to make the practitioner's work more attractive and more remunerative, but not by following the old, traditional, narrow path. The modern physician must, in the first place, not only join his County Medical Society but become an active participant in its deliberations if he would receive the full benefit of membership. He should become connected with a local hospital or a dispensary service equipped with a working laboratory. Moreover, he should become a socially, as well as professionally, useful member of society by joining welfare organizations, such as local tuberculosis societies, health centers, village improvement societies and the like. By virtue of his training, he should, quite naturally, assume leadership in all such movements. Thus equipped, he should successfully diagnosticate and treat from 85 to 90 per cent of all cases applying to him. I take it that Dr. Ullom's report on the experience of a general practitioner covered an equal percentage of cases dealt with by him without the aid of specialists.

Dr. Ullom has suggested that those following general medical practice should give special attention to internal medicine, surgery, obstetrics and pediatrics. It would obviously not be possible for the undergraduate student to specialize to any extent in these subjects, since he is obliged to meet a certain standard in all branches of the curriculum; but I quite agree that a graduate engaged in general medical and surgical practice should do this by taking post-graduate training at intervals.

There are several groups of cases that should be referred to specialists by the general practitioner. In the first place acute infectious inflammations, such as acute appendicitis, mastoiditis, cholecystitis and the like, which are early menacing to life, should be promptly referred to the surgeon. Again, in chronic cases that are obscure and remain so after careful study, expert counsel should be sought. There are many chronic cases that show a lethal tendency, and in such it is well to hold a consultation with an expert for the satisfaction it brings to both the patient's friends and the attending physician. Ophthalmologists and roentgenologists, as well as the laboratory expert, are constantly of great usefulness to the general practitioner, but unfortunately sometimes the latter fails to take advantage of these helps. The practitioner who is diligent and earnest in the service of his patrons earns and receives an adequate reward.

The Treatment of Syphilis with Bismuth. Report of Clinical and Experimental Studies.

BY JOSEPH V. KLAUDER, M.D.

The antisyphilitic properties of bismuth were first pointed out by Balzer in 1887. The basis of the large number of recent French reports concerning the use of bismuth in the treatment of syphilis is the work of Sazeroc and Levaditi, of the Pasteur Institute. These workers experimented upon the spirocheticidal action of a number of salts of bismuth, and they observed that tartrobismuthate of sodium and potassium is the most effective. It has also been observed that the metal bismuth, such as bismuth trioxide, is spirocheticidal.

Tartrobismuthate of sodium and potassium is given in an oil suspension or an aqueous solution. The latter is known commercially as Luatol, which is a neutralized solution. It is dispensed in 1 or 2 cc ampoules in a strength of 0.1 gm. per cubic centimeter. The oil suspension is dispensed in 2 cc ampoules containing 0.2 gm. of the drug. Another commercial preparation is known as Trepol, which is tartrobismuthate of sodium and potassium in an oil suspension, and Neotropol, which is precipitated bismuth in an isotonic solution. Most all of the French clinical reports on the use of bismuth in the treatment of syphilis embrace the use of the aforementioned preparations of bismuth.

This report is based upon the experimental and clinical use of the following drugs: An aqueous solution of tartrobismuthate of sodium and potassium (Luatol), potassium tartrobismuthate containing 62 per cent of bismuth and a suspension of bismuth trioxide in olive oil containing 81 per cent of bismuth.

It was observed in experimental syphilis in rabbits that the therapeutic active dose was 50 mg. of tartrobismuthate of sodium and potassium per kilo when given intramuscularly and the lethal dose 125 mg. per kilo. These figures also represent the therapeutic active and lethal doses of potassium tartro-

bismuthate. These drugs are extremely toxic when given intravenously; 5 gm. per kilo given intravenously is the lethal dose.

The lethal dose of the oil suspension of tartrobismuthate of sodium and potassium is much greater; about 200 mg. per kilo represent the lethal dose. The therapeutic active dose of an oil suspension of bismuth trioxide is 150 mg. per kilo injected intramuscularly; 400 mg. per kilo is the lethal dose.

Clinically the drug is administered solely by intramuscular injections in the same manner as is mercury. The dosage and interval of injections depend upon whether the soluble (aqueous) or insoluble solution (oil suspension) of the drug is given and also upon the tolerance of the patient.

The aqueous solution is given in a dose of 0.1 gm. in 1 cc; three such injections are given weekly until 2.5 gm. of the drug has been given; this constitutes a course of treatment. After about 1 gm. has been administered in consecutive injections the following symptoms of intolerance should be watched for: Foul odor to the breath and a blue line on the gums—bismuth deposit. In this event further treatment should be temporarily postponed or the dosage decreased, or the interval between injections increased. If these precautions are not observed, severe stomatitis may result. After 2.5 gm. of the drug has been given a rest period of about three weeks is instituted and a repetition of the above treatment is given.

The oil suspension of the drug is given in a dose of 0.2 gm. in 2 cc at intervals of four or five days until about 2.5 gm. has been administered. The foregoing symptoms of intolerance should be looked for and treatment interdicted if necessary.

Clinically the aqueous and oil suspension of tartrobismuthate of sodium and potassium, potassium bismuthate and bismuth trioxide appear to be equally effective, although clinical observations are still being conducted along this line. The oil suspension of the drug appears to be less toxic, and is less painful when injected locally. The local reaction after the injection of the various bismuth preparations is variable and is probably not more than after intramuscular infections of mercury. On

the whole, it is not an obstacle in the practical employment of the drug in the treatment of syphilis.

In primary syphilis after one injection of bismuth, treponema disappear from the surface of the chancre in from one to two days. Obvious syphilitic lesions completely involute after ½ to 1 gm. has been given.

The 4-plus Wassermann test of acute secondary syphilis becomes negative after 2 or 3 gm. have been given. The 4-plus Wassermann test of primary syphilis becomes negative after less an amount of the drug than is required to reduce the 4-plus reaction of secondary syphilis, and is roughly in proportion to the duration of the chancre. The 4-plus Wassermann test of tertiary syphilis becomes negative after a variable amount of the drug is injected and cannot be stated arbitrarily.

The therapeutic effects of the aforementioned preparations of bismuth in experimental syphilis of rabbits and in human syphilis were shown in lantern slides.

Bismuth is an effective spirocheticidal drug; it is not as effective as arsphenamin, but is more effective than mercury. As far as its therapeutic activity is concerned, it can be placed about midway between mercury and arsphenamin.

NOVEMBER 27

The Pathology of Thyroid Diseases[1]

BY ROBERT A. KEILTY, M.D.

The purpose of this presentation is not to cloud an already somewhat hazy atmosphere by a new classification, but to assemble facts already established, and with some new lines of thought work over the pathology of the thyroid gland from a different point of view.

[1] From the Department of Laboratories and Research Medicine, the George F. Geisinger Memorial Hospital, Danville, Penna.

The thyroid gland in this study has been viewed from the eyes of pathology applicable to other parts of the body, and not the rather prevalent viewpoint that it has reactions limited to itself and not in common with other organs. The role that bacteria may play as an etiological factor in many forms, especially thyroiditis, has received considerable attention. The use of certain terms is defined that confusion may not exist. The character of the study is outlined, showing the value of a complete correlation in each case. The following clinical types are enumerated. This is of value to the clinician, and is as far as one can go without more complete studies of the gland itself: All cases are either toxic or nontoxic. All cases may be divided into three groups: Group I, Hypertrophies; Group II, Thyroiditis; Group III, Neoplasms. The hypertrophies may be further subdivided into (*a*) functional, (*b*) pregnancy, (*c*) trophic—for example, nontoxic trophic hypertrophy. Thyroiditis is subdivided into acute, chronic and specific types. This will include a relatively large group of cases and is not confined to the rarer forms of suppuration. The neoplasms are benign or malignant—adenoma or fibroma, carcinoma or sarcoma, as the case may be.

The pathologist must needs go into more detail in determining types of changes in the thyroid gland, effecting the simplest possible grouping. In an examination of over 500 specimens from the gross, microscopical and bacteriological in 150 cases, all correlated with the clinical history, the following classification seems quite constant:

PATHOLOGICAL CLASSIFICATION OF THYROID DISEASES

I. Normal thyroid:
   No pathological changes.
II. Metamorphoses:
   Pathological A B C's as a part of more complete reactions:
      Congestion.
      Hemorrhage.
      Hyalinization.
      Calcareous infiltration.

III. Hypertrophy:

Increase in size and function.

(*a*) Response to function:

1. Physiological (adolescent goiter).
2. Pregnancy.
3. Trophic (colloid goiter).

(*b*) Simple hypertrophy with secondary reactions:

1. Chronic thyroiditis.
2. Tumor formation.

IV. Inflammation (thyroiditis):

(*a*) Acute
- Productive:
  1. Trabecular.
  2. Parenchymatous (exophthalmic goiter).
- Degenerative.
- Exudative.
- Suppurative.
- Gangrenous (post-traumatic).

(*b*) Chronic
- Trabecular productive:
  1. Cellular.
  2. Fibrous.
  3. Cystic.
  4. Calcareous.
  5. Osseous.
- Trabecular atrophic:
  1. Fibrous.
  2. Cystic.
  3. Calcareous.
  4. Osseous.
- Degenerative.

(*c*) Specific
- Tuberculosis.
- Syphilis.

V. Neoplasms:

(*a*) Benign
- Adenoma (epithelial origin):
  1. Single.
  2. Multiple.
  3. Cystic.
  4. Colloid.
  5. Degenerative.
  6. Productive.
  7. Fetal.
- Fibroma (mesothelial origin).

(*b*) Malignant
- Carcinoma:
  1. Simplex.
  2. Adenocarcinoma.
  3. Papillary.
- Sarcoma:
  1. Round-cell sarcoma.
  2. Endothelioma.
  3. Perithelioma.
  4. Myxosarcoma.

VI. Parasitic cysts:
Echinococcus.

VII. Teratomata:
Dermoid cysts.

The problems of foci of infection have played a prominent, although not the paramount, role in this study. In the completed study, gross pictures of the thyroid, accompanied by gross drawings emphasizing important points, photomicrographs and often clinical pictures, make up the whole.

Conclusions. 1. There is still a great deal of work to be carried on before the nature of diseases of the thyroid gland will be definitely cleared up.

2. The thyroid gland is only a part of the disease, but probably the most important part.

3. The term "goiter" might better be substituted by the term "thyroid disease."

4. Hyperplasia in thyroid disease is often not a hyperplasia in the sense of tumor formation, but numerical hypertrophy or proliferative in an inflammatory reaction.

5. The prevalent classifications are too heterogeneous in their makeup and one based upon clinical simplicity and pathological fundamentals is offered.

6. A large group of thyroid cases show glands which are not tumor as tumor is understood elsewhere, but which are productive, proliferating and inflammatory in character.

7. These inflammatory reactions are bacterial in origin, and secondary to foci of infection in the mouth or elsewhere.

8. These views are not in conflict with Marine's on the prophylactic value of iodine, but restrict the value of this procedure to the purely functional group, which is a large one.

9. The true neoplasms of the thyroid are very much in the minority, and their nature is as obscure as the nature of tumor elsewhere.

10. Much work is still to be carried on, and our views are open to modification by future data.

The Pathological Physiology of the Thyroid in Goiter

BY DAVID MARINE, M.D.
NEW YORK

(By Invitation)

It was with considerable hesitation that I accepted Dr. Beardsley's invitation to come to Philadelphia to discuss certain phases of thyroid physiology in relation to goiter. First, because the problem of simple goiter, both as regards prevention and treatment, is not a prominent one in this community. The relative merits of medical and surgical treatment in well-advanced cases of simple goiter, I believe, are fairly well understood. In the second place, I had some hesitation because my views as to the

nature of exophthalmic goiter were formerly very unpopular, and apparently they are only a little less so today. With your permission, therefore, I will touch upon these two great clinical divisions of goiter only indirectly, and would like to go over very briefly some of the recent experimental work on the suprarenal-thyroid interrelationship, which, I believe, ultimately will have an important bearing on the etiology of simple and of exophthalmic goiter.

The thyroid-sex-gland interrelationship is perhaps the oldest and one of the most striking of all known interrelations of glands with internal secretions. Known to the Babylonians in its crudest external manifestations, it has passed down to our time with but few additional facts. There is a great deal of evidence founded on embryology, pathology and experimental physiology —which I will not now go into—showing that the suprarenal gland is an integral part of the gonadal system. Thyroid enlargement is so intimately associated with the cyclic activities of the sex glands that it becomes one of the most important means of attacking the goiter problem. As is well known, removal of the sex glands usually causes a slight but definite decrease in metabolism, with involution of the thyroid gland. It is obvious, therefore, that it is not an insufficiency of the sex-gland function which stimulates the thyroid gland. By a process of exclusion, therefore, we have decided that the suprarenal gland must play an important part in the thyroid-sex-gland interrelation.

During the last twenty years the literature and thought concerning the suprarenal glands have centered around and have been dominated by epinephrin, the active principle of the chromophil tissue. The work of Asher and Flack, in 1910, first clearly demonstrated that epinephrin stimulates the thyroid. This has been confirmed since then from many sources. We also know, since the observation of Oswald, that epinephrin artificially introduced can enhance the physiological action of iodothyroglobulin, also artificially introduced. The Asher-Goetsch test is a clinical application based on these discoveries. I take it, therefore, as established, that epinephrin exerts a very definite

stimulating influence on the thyroid gland. It should be pointed out, however, that this effect is not an isolated one, since epinephrin stimulates all organs innervated from the sympathetic.

Concerning the suprarenal cortex, we have only the most fragmentary knowledge of its chemistry, physiology or pathology, and I propose tonight to go over very briefly some of our work during the last three years bearing on the possible function of the suprarenal cortex.

We have used the respiratory exchange as the best available means of demonstrating possible variations in thyroid function in relation to suprarenal injury. It should be pointed out, however, that the respiratory exchange is by no means an accurate gauge of thyroid activity. The effect of complete suppression of the adrenal function in dogs and cats shows that there is a fall in heat production, beginning shortly after the operation and continuing to death. Such experiments, however, throw no light on the possible glandular interrelations, because all mammals may be considered as dying from the time of total removal of suprarenal tissue. It is therefore necessary to practice partial removal, *i. e.*, a severe but sublethal injury. The first instance where this was attempted was by Golyakowski, in 1899, who, working with dogs in which he practised a mass ligation of the suprarenal glands, reported a marked increase in heat production, beginning within a week after the injury and continuing for as long as six to eight weeks. So far as I have been able to find, no further work was undertaken until 1920, when we began similar observations on rabbits and cats. In rabbits we have produced suprarenal insufficiency, first, by removal of the glands, and, secondly, by freezing the cortex with ethyl chloride. In cats we have, in addition, utilized the method of vein ligation which has the advantage of causing very little injury to the nerve supply, which, since Dreyer's experiments, we know controls the discharge of epinephrin. Complete metabolic studies have been carried out on 39 rabbits with intact thyroids in which the suprarenals were removed and on 15 rabbits in which they were frozen. It has been found that the reactions as regards heat

production following these forms of crippling the suprarenal function may be divided into three groups, as follows:

1. Those that live indefinitely with no appreciable alterations in metabolism.
2. Those that show an increase in respiratory exchange.
3. Those that show a fall in respiratory exchange.

Of 33 rabbits in which both suprarenals were completely removed, 27 (82 per cent) showed a rise in heat production varying from 10 per cent to 63 per cent; 4 (12 per cent) showed a fall in metabolism to death; 2 (6 per cent) showed no significant change or departure from normal behavior. The rise in heat production following sufficient injury to the suprarenals is absolute. Increased heat production usually begins in from three to six days after suprarenal injury and continues from a few days to several months. The longest period in which increased thermogenesis has been followed in an individual rabbit was twenty-three weeks. Infection, trauma and nerve injury, we believe, may be eliminated as important factors. The simplest explanation for this increased heat production, with the facts at present available, is that it is in part due to increased thyroid activity brought about by the removal of the regulatory and inhibitory influence normally exercised by the suprarenals, and that it is dependent upon cortical rather than medullary function, since, while epinephrin normally stimulates the thyroid, in the operation of double suprarenalectomy most of the chromophil tissue is removed. Yet in spite of this loss an increase in heat production occurred in 82 per cent of the rabbits.

In order to determine whether the thyroid was a factor in the increased heat production, we have performed 15 experiments as follows: After control heat production measurements had been made over a period of two or three weeks, the thyroid glands were removed and the metabolism allowed to fall to its lowest level, which usually takes about three weeks, and then the suprarenals were removed, either in one or two sittings, and heat production measurements continued until death or until further observations seemed unnecessary. In only two instances were

there significant rises in heat production after adrenalectomy above the level obtaining after thyroidectomy, and in no instance did it rise to the normal level. The striking feature of these experiments is the absence of a significant rise in 13 of 15 rabbits in which suprarenalectomy was performed after thyroidectomy; while, as mentioned above, a rise of over 10 per cent was obtained in 27 of 33 rabbits where the suprarenals were removed with intact thyroids. Further, there is evidence that the iodin store in the thyroid is markedly reduced during this period of increased heat production following injury to the suprarenals; indeed, it causes a more rapid loss of iodin than any other known means. Further, we have been able to cause secondary rises in heat production merely by the administration of a few milligrams of iodin.

These facts, we believe, establish another thyroid-suprarenal interrelationship, which, with our present knowledge, seems to depend upon an antagonistic action of the thyroid and suprarenal cortex. The fact that the increased heat production occurs after removal of most of the chromophil tissue shows that epinephrin has very little if anything to do with it. We believe if increased epinephrin discharge could be combined with the cortical insufficiency a very much greater rise in heat production could be brought about. In other words, while epinephrin is a powerful direct stimulus to increased thyroid activity, the withdrawal of the inhibitory control exercised through the cortex is a much more powerful stimulus. Many control experiments, of course, have been made, and animals in which large fragments of suprarenal cortex, or in which large accessory masses of cortex were found, usually do not show an increase in heat production. As to the means by which the cortex normally exercises a control over thyroid activity, nothing definite is known. There is considerable evidence of the presence of a substance in the cortex capable of depressing the functional activity of the thyroid cells. We would also like to emphasize that while the thyroid-cortex interrelationship appears to be an important one, it is not believed that it is an isolated or independent one, but, on the contrary,

there is abundant evidence that the function of the suprarenal gland is intimately and vitally related directly or indirectly to many other tissue functions.

As regards the possible clinical associations in which this thyroid-suprarenal cortex interrelationship may be concerned, I would like to mention two briefly: (1) The involution of the suprarenal cortex of infants, and (2) exophthalmic goiter. The involution associated with a marked decrease in volume of the human suprarenal cortex beginning in the second week of extrauterine life is a remarkable destruction of the two inner layers of the cortex. This involution is initiated as a hemorrhagic infiltration going on to necrosis, and finally absorption of these layers with a folding and collapse of the glomerular zone onto the medulla. The suprarenal gland at the end of the third year of life is considerably smaller than at birth. So far as known this involution occurs only in human infants. It begins during the second week of life whether the infant is a premature or full term. This involution also occurs in accessory cortical masses. Probably many of the fatal cases with extensive hemorrhage into the suprarenals of infants are abnormal and exaggerated instances of this apparently normal hemorrhagic destruction. The physiological significance of this cortical destruction is still unknown, and curiously does not seem to have attracted the attention either of physiologists or clinicians. The idea advanced by certain pathologists that the destruction occurs to allow the medulla to grow or to increase the area of contact between the cortex and medulla seems inadequate. That it is a systemic reaction in some way connected with the preparation of the infant for extrauterine life and growth does not appear to have been considered. In the light, therefore, of the relation of experimental injury of the cortex to increased heat production already described for rabbits, cats and dogs, it occurred to us that possibly this normal destruction in infants might in effect be a naturally occurring similar physiological process and in some way closely connected with the preparation of the infant for extrauterine life and growth; in other words, that this involution in infants might

be associated with increased heat production, just as in the case of experimental suprarenal injuries in animals.

It is well known that the metabolism rises rapidly during the first few months after birth and ordinarily reaches its maximum intensity between the tenth and twelfth months. We have studied a series of ten babies, making heat production measurements every second or third day from birth to the thirtieth day of life. The average normal metabolism of babies is fairly well known, but, strange as it may seem, there are no records where the same baby was observed over a period of a month. The classical studies of Benedict and Talbot, dealing with over 100 normal babies, stopped at the seventh day of life. Without burdening you with further details, I may state that there is a sharp rise in heat production beginning during the second week of extrauterine life which coincides exactly with the cortical destruction as regards time relations. Our average metabolism grouped by weeks for the ten babies were as follows:

	Cal. per. Kg. per hour.
First to seventh day	1.88
Eighth to fourteenth day	2.14
Fifteenth to twenty-first day	2.15
Twenty-second to twenty-eighth day	2.30
Twenty-ninth to thirty-fourth day	2.24

Benedict and Talbot give 1.75 and Murlin gives 1.87, as the average normal metabolism between the first and seventh days, while our average was 1.88. Benedict and Talbot, further, noted the fairly constant daily heat production from the first to the eighth day, and also pointed out that in six infants there was a sharp rise on the eighth day. Unfortunately, they did not follow their studies longer than the eighth day.

Exophthalmic Goiter. Students of thyroid physiology and pathology have long insisted that we must look beyond the thyroid for the essential and primary lesions of this disease. A similar view was expressed by me in 1911, as follows: "The essential physiological disturbance in the thyroid in exophthalmic goiter is a relative insufficiency, its reaction compensatory and its significance symptomatic." The fact that sufficient injury of the

suprarenal function in rabbits, cats and dogs with intact thyroids leads to a chronic increase in heat production, and that removal of the thyroid prevents it, seems to us of the greatest importance as regards the etiology of exophthalmic goiter. We believe this is the nearest approach to the experimental production of this disease in animals yet obtained. Indeed, the clinical manifestations in the very acute cases of exophthalmic goiter are almost identical with the clinical manifestations produced in rabbits and cats by sufficient but sublethal suppression of the cortical function.

A new conception of exophthalmic goiter is now possible, which, though differing widely from the still popular theory, offers a rational explanation for many of its most important manifestations. This conception will explain the continued lymphoid and thyroid stimulation as in part dependent upon a weakness or exhaustion of the suprarenal cortex associated with normal or increased functional activity of the chromophil tissues. I do not believe that cortical injury alone or combined with increased epinephrin discharge will fully explain exophthalmic goiter. I do believe that these represent two of the essential alterations from which many of the disturbed interrelations directly or indirectly arise. The recent work of Black, Hupper and Rogers, if confirmed, would further support this view. They report that feeding a suprarenal residue (nature not stated) increases the iodin store of the thyroid. I have just mentioned that sufficient destruction of the suprarenals increases the discharge of iodin from the thyroid.

During the last three years we have been feeding fresh and dried ox suprarenal cortex to selected cases of exophthalmic goiter at Montefiore Hospital. This treatment is not new, having been tried by Dr. Solis Cohen, of this city, in 1897, and since then by several other observers. All previous observers have used the dried suprarenal gland. We have been unable to obtain any effect from the dried preparations, but have obtained very encouraging results in a series of about 20 cases by feeding a

glycerol emulsion of the fresh cortex. Two most striking effects have been observed, viz., a rapid gain in weight and in muscle strength. We have been unable to obtain changes in heat production and in the pulse-rate which could not be easily explained on the basis of rest. We have been studying the effects of these emulsions and of various extracts on rabbits for the past year, and can definitely state that feeding emulsions by mouth materially reduces the heat production in rabbits. We have, so far, been unable to get any extracts sufficiently free from epinephrin to study their effects without the epinephrin influence. It is our opinion that the administration of fresh suprarenal cortex emulsions deserves a more extensive trial and study, particularly in cases of early Graves's disease, and if found beneficial attempts will be made to isolate or at least concentrate the substances in the suprarenal which can depress thyroid activity.

DISCUSSION

Dr. Solomon Solis Cohen: No subject better illustrates Pope's adage, "A little knowledge is a dangerous thing." Perhaps in no field of medicine have so many unwarranted generalizations been made on insufficient and misunderstood data. I have been studying the disorders of the thyroid and allied or opposing glands all my medical life, and the more I learn the greater becomes my realization of ignorance—of the extent of the field of normal and pathologic physiology still awaiting illumination. It is therefore impossible to be dogmatic; I can only state facts of observation, inferences, theories, opinions as such, holding everything subject to correction by the future advance of science.

The feeding of whole adrenal substance to subjects of exophthalmic goiter, which I introduced long ago, was based on the theory of antagonism between the physiologic actions of the two glands. Especial attention was called at that time to certain temperature relations, as shown by the differing reactions of patients with autonomic disorders to season, weather and climate. Thyroid substance appeared to be harmful—and adrenal and thymus substance beneficial—in subjects of autonomic imbalance (*ataxia autonomica*) who suffered excessively from summer heat, and the reverse appeared to be the case in those who suffered excessively from winter cold, especially when the causative heat and cold were of moderate degree.

These observations, taken in connection with Owen's reports of the good effects of thymus feeding in exophthalmic goiter, and the known persistence or enlargement of the thymus in that disorder, were suggestive both of antagonism between thymus and thyroid, and of a certain degree of alliance or supplementation between thymus and adrenal. Doubt has of course been thrown on this by later developments; but I find myself unable to agree with those who deny all secretory function to the thymus and look upon its recrudescence in Graves's disorder simply as a lymphatic enlargement. In this, as in so many other details of the autonomic-endocrin functions, we wait further discoveries.

The important thing is to recognize the limits of our exact knowledge as to particulars, and to emphasize the necessity of a broad, general, biologic view of the intimate relations of thymus, thyroid, pituitary, adrenal, pancreas—perhaps also pineal—among themselves and with the vegetative nerve system, *i. e.*, with the autonomic system as a whole or with its divisions, if one chooses to speak rather of sympathetic, parasympathetic, etc. I prefer to think of all of these—and to speak of them—as one great taxic or coördinating mechanism, with an intracranial, if not cerebral, center, as yet eluding the anatomist but evident to the clinician. The consiliences of the chromaffin bodies and the sympathetic nerves are well established, and certain histologists have reported the discovery of cells which it would be hard to characterize either as gland cells or as nerve cells—in other words, transitional tissue elements. This, together with what is known of the physiology of organic life, warrants one in speaking of the endocrin bodies as hypostases of autonomic nerve energy; or, if a different figure of speech be preferred, as transforming depots and stations wherein nerve impulses are converted into chemical agents and sent by way of the vessels to tissues beyond nerve reach.

Disorders in the various parts of this great coördinating system may be manifested most widely and diversely. I once characterized them as multiform and multiregional. They may be organized into more or less definite syndromes, such as Graves's disorder and Raynaud's disease, migraine, hayfever or asthma, or they may present vague and puzzling symptoms apparently of cardiac, gastroenteric, renal or other organic origin. The great characteristic is incoördination, imbalance, ataxia—shown paroxysmally or with paroxysmal exaggerations, just as one would expect from an electric apparatus in which accumulations and discharges of energy had become irregular and unequal. Thus, disorder of the thyroid may originate, or may be dependent upon, disorder of the adrenal, and *vice versa*. Either may originate, or may be dependent upon, autonomic disorder, and *vice versa*. Excessive or perverted thyroid activity may lead to excessive or perverted adrenal activity in attempts at (antag-

onizing) compensation; itself be an attempt at compensating (by antagonism) adrenal excess or perversion; or it may be a result of deficient adrenal activity.

Neither clinical nor experimental data permit of dogmatism; but one sees cases in which he must form a tentative opinion; and so-called thyroid disease frequently appears to have its origin elsewhere than in the thyroid gland. The difficulty of discrimination is not lessened by consideration of the role that emotion plays in disturbance of both the thyroid and the adrenal—a fact so admirably epigrammatized in Blake's characterization of Graves's disorder as "a crystallized fear."

Surgery—thyroidectomy or thyroid ligature or both—may be the best means to break a vicious circle in a given instance; or other destructive measures, such as the use of *x*-ray or radium, may be applicable. Yet there are many cases in which, despite skilful surgery or other destructive measures, the real symptoms, *i. e.*, the tachycardia and the nervous disturbances, persist; just as there are many cases in which these symptoms, with or without the exophthalmos, are manifested in the absence of any goiter, either above the clavicle or substernal. On the other hand, there are many cases in which goiter—that is to say, thyroid enlargement—persists in greater or less degree after the exophthalmos and the cardiac and nervous disorders have been entirely controlled by non-surgical measures.

I hesitate always to use the word "cure" in any connection, but, surely, the cases in which, although goiter remains as a deformity only—and often not even that, but merely a not unsightly fulness of the throat, all functional disturbances having disappeared—such symptomless cases surely are better entitled to be called "cured" than those in which the goiter is gone but the patient remains wretched.

Surgery, then, is not, in this condition, radical. It does not cure, but palliates. It does not reach the source of the disturbance, but deals with an incident in the development of a complex disorder: An important incident, it is true, and one giving rise to many distressing epiphenomena, but whose magnification serves only to lead astray professional attention and therapeutic effort. When, however, the goiter in itself constitutes a mechanical difficulty, threatening life or comfort by its pressure on nerves, vessels or windpipe; or when it is a deformity so great as to excite emotional distress; or when the patient's circumstances and environment are such that rest, partial or absolute as necessary, cannot be carried out for a sufficient time; or when the medicinal or other therapeutic measures necessary in an individual case cannot be obtained—surgical procedure must needs be advised. So far as I can judge from personal observation and from study of the records, the instances in which surgery is necessary

for other than economic reasons might amount, at most, to 10 to 15 per cent of all cases seen. No percentage estimate can be made of the instances in which it must be undertaken because other therapeutic measures cannot be carried out.

The proportion of recoveries in cases suitable for non-surgical treatment —including those in which recovery may have been spontaneous, those in which the treatment may have helped, and those in which the treatment may have delayed it—is from 80 to 85 per cent. If the cases non-surgically treated could be carefully selected and placed under proper care sufficiently early a much higher recovery percentage could confidently be expected. Too often the diagnosis is belated and the care of the patient imperfect.

I do not think it necessary to detail specific measures of treatment, since there are so many types and varieties of cases encountered. Thymus feeding, adrenal feeding and various forms of electrical application are all useful in selected cases. Radium and *x*-ray applications are to be classed with surgical measures. Various forms of medication have their advocates, their opponents, their successes and their failures. But in any plan of non-surgical treatment, rest, physical and mental, must be an important element, and time is "of the essence of the contract." The best of hygiene is necessary. The diet, the secretions, the excretions, must receive due attention. Beyond that, each patient is an individual study, and whatever general line of treatment is adopted will need modification from time to time in accordance with the special symptoms shown, the stage of the disorder and the changes that take place during the progress of the case.

I might briefly allude to the defensive function of the thyroid gland, especially in the immune members of families liable to tuberculosis and cancer, and the immune families of tuberculous and cancerous clans. Its enlargement is often associated in these persons with mild—or even, at times, with severe—autonomic disturbances; but interference in such cases must be cautious. They are apt to show especially a delicate thyroid-adrenal balance. In one instance thyroid feeding undertaken by the patient to reduce obesity apparently provoked marked adrenal excess—manifested, however, by vascular constriction, resembling Reynaud's disorder and thus in the domain of the chromaffin tissue rather than of the cortex.

DECEMBER 12

Necrosis and Gangrene of the Urinary Bladder. A Review of 150 Cases, Including 18 Not Previously Reported

BY T. GRIER MILLER, M.D., AND CHARLES C. WOLFERTH, M.D.

Within a period of slightly more than a year 5 patients with necrosis or gangrene of the urinary bladder wall have been observed clinically, and on 4 of these autopsies were obtained. Thirteen other cases were discovered in a search through 5250 autopsy records, available through the courtesy of Dr. Allen J. Smith. These findings suggest that the condition is not so rare as the clinical and pathological text-books suggest. Only 132 cases were found in all the literature.

On the basis of the assembled 150 cases the etiology, pathology, diagnosis and prognosis are discussed. There is no unanimity of opinion as to the cause of the lesions, but infection is probably the important factor, though it is possible that circulatory disturbance alone may cause it. Other predisposing causes are urinary retention, the injection of irritants and trophic bladder conditions.

The pathology varies with the extent, duration and severity of the process, in the most marked cases the entire bladder wall becoming gangrenous and being exfoliated as a sac. The diagnosis is suggested by the occurrence of bloody, purulent and fetid alkaline urine in patients who have had urinary retention. It is further supported by frequent interruptions of the urinary stream per catheter and confirmed by the passage of necrotic bladder tissue. Eighty-four out of 146 patients died while the lesion was present, but it cannot be asserted that all the deaths were due to this cause alone.

PROCEEDINGS

OF THE

SECTION ON INDUSTRIAL MEDICINE AND PUBLIC HEALTH

FEBRUARY 24, 1922, TO APRIL 28, 1922

FEBRUARY 24

Syphilis and Trauma: The Workmen's Compensation Act, the Industrial Physician and the Syphilitic

BY JOSEPH V. KLAUDER, M.D.

(*Abstract*[1])

A LATENT syphilitic infection may in some cases play an important role as a factor in the immediate and late consequences of trauma. Although the relation of trauma to syphilitic lesions has long been recognized, recent laws governing workmen's compensation have made this of considerable importance. Injuries to syphilitic soldiers during the recent war brought up important questions regarding pension, retirement and compensation for such individuals.

The relationship is of particular importance to physicians engaged in industrial medicine. However, he alone does not share in its interest. The surgeon is cognizant of syphilis as a factor

[1] The complete paper was published in the Jour. Am. Med. Assn., April 8, 1922, lxxviii, 1029–1037.

in the nonhealing of wounds and the nonunion of fractures. The ophthalmologist has observed interstitial keratitis appearing after trauma incident to a foreign body in the cornea of a syphilitic. The laryngologist is reluctant to perform a septum operation on a syphilitic. The internist is aware of the role that trauma plays in the cause of aneurysm. The psychiatrist realizes that it is not syphilis alone that causes paresis, but syphilis plus something else; head trauma can be ascribed as a determining factor in the production of paresis in a certain number of syphilitics. In short, trauma in a syphilitic may determine the site of syphilitic lesions in most all organs of the body.

The relation of trauma to the development of syphilitic lesions can be considered from two views—the medical and the medico-legal. The medical aspect will first be considered and then the medico-legal.

In addition to syphilis, trauma may determine the site of other diseases—tuberculosis, particularly of the bones and joints, psoriasis, lichen planus and xanthoma tuberosum.

The influence that trauma exerts in the causation of syphilitic lesions is frequently seen by the dermatologist in the following ways: In the frequency of mucous patches and of syphilitic glossitis in excessive smokers; in condylomas resulting from irritation of secretions and excretions; in the squamous syphilides of the palms in those engaged in laborious occupations; in syphilitic lesions developing after tattooing and in the observation that a gumma as seen cutaneously not infrequently appears at the site of previous trauma.

When syphilitic tissue is subjected to trauma inflicted in various ways the following may occur: Healing of the wound may be delayed. In this event antisyphilitic treatment facilitates or causes healing to take place. The wound may gradually assume the appearance which is characteristic of the different forms of tertiary syphilis. After healing has taken place a syphilide may develop in the scar.

Not only may syphilitic manifestations develop in the skin and muscles when these are subjected to trauma, but other organs—

the osseous system, viscera and nervous system—may similarly react after the infliction of trauma.

A review of the literature is made. Cases are cited from the literature, together with case histories presented, which show how trauma influenced the localization of syphilis in most all organs of the body.

The development of aortic aneurysm following injuries to the chest, traumatic paresis, the fragility of bones in syphilis and the role that syphilis plays in the cause of delayed union and nonunion of fractures are discussed.

Negative results are reported of attempts to produce syphilitic lesions at the site of trauma in syphilitic rabbits.

Possible explanation of the appearance of syphilitic lesions at a previous traumatized area is discussed.

Case histories are given which apparently show how a negative Wassermann in a syphilitic may, after trauma sustained by the individual, become positive. This is termed the "traumatic provocative Wassermann." This phenomenon is discussed.

The Workmen's Compensation Act and the Syphilitic. Workmen's Compensation. Burden of Proof Arising Out of and in Course of Employment. The burden of proof rests upon a claimant for compensation made under the workmen's compensation act to show, by competent testimony, not only the fact of the injury, but that it arose out of and in the course of the employment of the claimant, and such proof must be based upon something more than a mere guess, conjecture or surmise. When a workman dies from a preëxisting disease, if the disease is aggravated or accelerated under certain circumstances which can be said to be accidental, his death results from accident.

Abstracts of some medico-legal cases are given in which a syphilitic workman sustained injury which resulted in divers results. The verdicts rendered by the Compensation Board in awarding compensation to these individuals are quoted.

The attitude of the industrial physician to the syphilitic workman is discussed. It is pointed out that the procedure of taking a routine Wassermann in the employment of workmen and refusing

work to the syphilitic as a means of defeating the liability of the employer, in so far as the syphilitic is concerned, is wrong sociologically, since it would discriminate against all syphilitics, and syphilis is by no means an uncommon disease.

No neurosyphilitic or workman with cardiovascular syphilis should be placed in a position of a hazardous nature. The potential danger of paresis, on the one hand, and a traumatic aortic aneurysm, on the other hand, is too great. The status of pupillary abnormality as an aid in the diagnosis of neurosyphilis is discussed.

When an employee sustains an injury it should be a routine procedure on the part of the industrial physician to have the Wassermann test made. If positive, antisyphilitic treatment should at once be administered. In this way untoward results of the injury will doubtless be prevented.

If a syphilitic has sustained severe head trauma and possibly cerebral injury, prolonged rest with intensive syphilitic treatment should be carried out. In this circumstance, the wisdom of performing a lumbar puncture for diagnostic purposes soon after the injury can be questioned in view of the disturbance of the meningeal-choroidal mechanism caused by lumbar puncture. In this way it is possible experimentally to infect the neuraxis from the blood.

Tuberculosis as it Affects the Industrial Worker*

BY FRANK A CRAIG, M.D.

The relationship between tuberculosis and the industrial worker is so complicated and involved, and presents so many phases of interest to the industrial physician, that it would be impossible to do more than refer briefly to certain of the more important phases of the subject. There is no disease which is so important

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from the standpoint of the industrial physician, as it appears in so many varied forms and may so completely disable the workman, frequently after a prolonged period of partial disability with the loss of a considerable amount of time and efficiency. The onset is usually so insidious that the disease becomes well advanced before its true nature is recognized.

During recent years great stress has been laid upon the importance of childhood infection with tuberculosis, and the frequency of adult infection has been questioned; but the studies upon which this view is based are of such a character that it would seem inadvisable to neglect any of the precautions which have hitherto been employed to prevent the dissemination of the tubercle bacilli among adults. In industry the detection of the disease is of the utmost importance to the employer, the employee affected and his fellow-workers.

The relationship between tuberculosis and industry constitutes one of the most important problems bearing upon the prevention of this disease, the solution of which unfortunately presents many difficulties. It is almost impossible to determine in any individual case how important a part has been played by occupation and to what extent home environment and mode of living have been responsible for the development of the disease. A weak point in most of the studies of tuberculosis in industrial bodies lies in the fact that the home conditions of the workers have been ignored. The disease is extremely prevalent among the poor industrial workers—that large group which is usually exposed to crowded, poor living conditions, poor food, dissipation and similar factors which we know may be responsible for the development of the disease and may favor its spread.

There can be no question that working under unfavorable conditions results in an increase of the disease and that improvement of the general hygienic conditions of the plant is followed by a reduction in its frequency. Industry, then, bears the same relation to tuberculosis that the home environment bears to it; it is just as essential that the working conditions should be favorable as that the home conditions should be. In studying tuberculosis

in any given industry one must not only consider the special trade processes involved, but also the general conditions as to light, ventilation, etc. There are certain trade processes and occupations, especially those in which irritative types of inorganic dust constitute a hazard, which have such a high mortality rate from tuberculosis that they have always been regarded as definite predisposing factors.

The effects of industry have been summarized by Dr. Hayhurst[1] as follows: (1) Deaths from industrial diseases are rare; (2) specific occupational diseases, such as, for instance, those due to poisons, are fairly common; (3) nonspecific occupational diseases, represented by chronic infections and degenerative processes, are very common; while (4) health complaints in which the occupation enters as a chief factor are almost universal. He further states, "It is startling when we realize that such an innocent occupation as that of the telephone girl is associated with a tuberculosis rate of 43 per cent of all deaths among this class of workers, and that the stenographer suffers a rate of 39 per cent from the same disease."

Another phase of the tuberculosis problem of considerable practical importance, especially from the standpoint of the industrial plant, is the relationship between pulmonary tuberculosis and trauma. Evidence regarding a sufficient number of cases has been established in which tuberculosis has followed traumatism—in individuals known to have been free of all evidence of the disease prior to the injury—to warrant one in accepting trauma as a possible cause for the development of the disease. The physical examination of applicants for employment and the frequent reëxamination of employees are the only means of protection which a plant possesses against being unjustly held responsible for tuberculosis in persons who, when injured, claim that the traumatism is responsible for the disease.

When one studies the frequency with which tuberculosis is encountered in industrial bodies one encounters difficulty in securing data so formulated that a definite comparison of one plant with another can be made. Some statistics refer to males, some

to females and others to both sexes. In some instances, where both sexes are included, the proportion of males and females, with the corresponding rates, is not given. Often no mention whatever is made of the sex of the workers. Similarly no distinction is made between white and colored workers. Very few statistics give the average age of the workers and practically none are arranged according to age group. Rarely is mention made of the exact occupation of the individuals affected. Occasionally the number of examinations is given, but generally no reference is made to the total number of workers employed, the reason for the examination, the method of examination or the grounds upon which the diagnosis was based, etc. Some physicians employ the term "serious lung defect," and fail to state the nature of the defect; some include suspected tuberculosis and definite tuberculosis under one heading; others include them under separate headings. It is not surprising, in view of this lack of uniformity, that the tuberculosis incidence rates in the accompanying table, which I have collected from various sources, show such an exceedingly wide variation, running all the way from 0.02 per cent to 6 per cent. The definite tuberculosis cases in which the complete figures are given show an average of 1.494 per cent.

The great variation between the findings of the different authors in various industries cannot be accepted as being indicative of the influence of the industry itself upon the prevalence of the disease, as there are too many other factors which must also be taken into consideration—such as age, sex, color, methods employed and the individual opinion of the examining physician as to what physical signs and symptoms are to be considered as indicating the presence of the disease and as to what care was exercised in making the examination. This personal equation of the examining physician is probably one of the most important factors involved. While the incidence rates given in this table are by no means constant, they are sufficient to indicate that the disease is so generally prevalent as to warrant our employing every possible means to prevent it.

TUBERCULOSIS RATES IN INDUSTRIAL STUDIES COLLECTED FROM VARIOUS SOURCES

Author.	Industry.	Title of defect.	No. of cases.	Incidence rate, per cent.	No. examined.	Applicants.	Employees.	Male.	Female.
Auel[2]	Electric mfg. co.	Serious lung defect	17	0.09	18,390	..	x	x	
	" " "	" " "	44	0.14	29,805	..	x	x	
	" " "	" " "	90	0.50	17,858	..	x	x	
	" " "	" " "	2	0.05	3,628	..	x	..	x
	" " "	" " "	4	0.07	5,583	..	x	..	x
	" " "	" " "	1	0.03	2,944	..	x	..	x
Buzby[3]	Leather works and cannery	Unquestionable tuberculosis	—	0.80	1,500	x	x	x	x
Lowman[4]	Steel company	Lung disease	35	0.28	12,302	x	x	x	x
	" "	" "	59	2.42	2,430	x	x	x	
Kellogg[5]	Department store	Active tuberculosis	19	3.80	500	..	x	x	x
		Inactive tuberculosis	8	1.60	(2000 employees; 85 per cent females)				
	" "	Active tuberculosis	6	3.00					
		Inactive tuberculosis	2	1.00	200	x	..	x	x
Kellogg[6]	" "	Tuberculosis	42	3.47	1,210	..	x	x	x
Clark[7]	Grinding company	Lung rejections	5	0.19	2,618	x	..	x	
Cutler[8]	" "	Pulmonary tuberculosis	10	0.50	2,000	x	..	x	
Scheffel[9]	Not stated; medium but hazardous	Tuberculosis	1	0.33	300	..	x	x	
Britton[10]	International Harvester Co.	"	—	0.88	About 20,000	..	x	x	x
			—	0.54	About 20,000	..	x	x	x
Schereschewsky[11]	Garment workers	Pulmonary tuberculosis	65	3.11 } 2.49	2,086	..	x	x	
				0.90 }	1,000	..	x	..	x
	" "	The same	9						
Price[12]	Bakers	" "	—	2.40	800				
	Tailors	" "	—	1.60	800				
	Tobacco workers	" "	—	1.30	600				
	Furriers	" "	—	6.00	83				
Fisk[13]	Insurance policy holders	Possible tuberculosis of lungs	—	1.40	——	..	x	x	x
	Commercial employees	The same	—	0.90	——	..	x	x	x
Mock[14]	Clerks, 35 per cent								
	Light skilled, 20 per cent	Active tuberculosis	—	1.70	112,000	..	x	58 per cent	42 per cent
	Heavy manufacturing and laboring, 45 per cent								
	Miscellaneous; reports of ten surgeons	" "	—	1.40	——	..	x		
	Steelworkers: U. S. P. H. S.	" "	—	0.92	936	..	x		
Robinson and Wilson[15]	Miscellaneous	Pulmonary tuberculosis	—	1.07 } 1.10	14,049	..	x	x	
				1.89 }	5,883	..	x	..	x
Craig	Policemen and firemen	The same	103	1.80	5,706	..	x	x	
War Department[16]	Drafted men	Pulmonary and suspected tuberculosis	—	2.202	——	..	..	x	
	Drafted men in Pennsylvania	The same	—	1.947	——	..	..	x	
Doty[17]	Telegraph Co.	Tuberculosis	36	0.49	7,201	x	..	68 per cent	32 per cent

Viewing the problem from a slightly different angle it is interesting to see how many days per employee are lost annually through tuberculosis. In his excellent article on industrial absenteeism, Dr. Quinby[18] states that in the industrial plant of which he is medical director, pulmonary tuberculosis was responsible for the loss of 0.246 days per employee during the year 1920. Excluding acute infections of the upper respiratory tract, tuberculosis had the second highest rate of any disease or group of diseases. Diseases of the stomach had a higher rate (0.297) and rheumatism had a slightly lower rate (0.235). This gives one a clear appreciation of the importance of tuberculosis from the industrial standpoint.

Fortunately we have at our command a method of detecting tuberculosis among industrial workers, namely, by means of entrance examinations combined with periodic health examinations. If carefully conducted this procedure will undoubtedly help materially to reduce the number of cases within a relatively short period of time, provided the hygienic condition of the plant is good. It must be borne in mind, however, that by examinations I mean complete examinations for all defects and diseases, for it is neither practical, economical nor expedient to conduct an investigation of this kind for the detection of one disease alone. As a matter of fact, every defect or disease detected and corrected and every step taken to improve the health and well-being of the individual is a step toward the prevention of tuberculosis.

The entrance examination has been fairly generally employed and is in operation in a large number of plants because it is a procedure which more readily appeals to the employer, promising a definite, tangible return by eliminating the seriously disabled and diseased workmen and also serving as a control on the type of work which may be performed by workmen with a moderate disability, preventing them from engaging in an occupation which would aggravate their defects. The results to be obtained by periodic health examinations are not so obvious to the employer, and consequently it is difficult to convince him of the value of a health program in which both entrance examinations and periodic health examinations are included.

While the entrance examination may serve to keep out of the plant seriously diseased individuals and may help to place men at work for which they are physically fitted, it is concerned only with the new employee—usually the least valuable to the plant—and does not include the valuable workmen who have been in the employ of the plant for some time. Any attempt to keep these older employees under observation by examining them when sick is of relatively little value to the plant; they should be examined periodically before they become actually ill, when the first manifestations are present, and at a time when a change of occupation, perhaps, or treatment while at work, may be sufficient to prevent illness.

Tuberculosis is a disease which, like many others, usually develops insidiously, the patient frequently not considering himself ill until the disease is well developed or even advanced. This fact was strikingly illustrated in the examination of the policemen and firemen of the city of Philadelphia, recently conducted by the Phipps Institute of the University of Pennsylvania, in which nearly two-thirds (64 per cent) of the cases of tuberculosis discovered had previously been entirely unsuspected, even by the affected individuals themselves.

In order to prevent the infection of other workmen and to secure a retention of the working capacity of the individual affected with tuberculosis, with the loss of only a relatively short period of time, the disease must be discovered early. There is no method for this early detection of disease which is at all comparable with periodic health examinations.

For the foregoing reasons I would like to make a special appeal for the installation of this method of study in every industrial establishment. While serious objection will, no doubt, be raised to such an elaborate and time-consuming procedure, I believe that the difficulties are not insuperable and that the results obtained would more than compensate for the cost involved. It is impossible to estimate how great would be the influence upon the public health of a widespread employment of periodic examinations. A recent study of periodic health examinations by one

of the large insurance companies has clearly demonstrated their economic value to such an organization, and I can see no reason why they would not be of equal financial value to an industrial plant. There can be no question that, from the standpoint of tuberculosis at least, the general employment of periodic physical examinations would constitute one of the most effective measures that could be devised for the advancement of preventive medicine.

To be of value it is essential that the examinations be made with thoroughness, care and precision, otherwise the early cases of tuberculosis will be overlooked. There is no disease which varies more in its clinical manifestations than does tuberculosis; in some cases the general symptoms predominate and in others the pulmonary signs are most marked. The latter type of case is more easily recognized by the examining physician than the former, which is frequently confused with some other disease. While the early recognition of the disease is not always easy, in the majority of cases a careful examination will reveal its presence. It is a mistake to view the early diagnosis of pulmonary tuberculosis as a very difficult procedure, requiring expert training, employment of the roentgen rays and similar costly methods. More early cases pass unrecognized, through carelessness or neglect to examine, than are undetected on account of lack of training. There are, to be sure, a certain number of cases which tax one's diagnostic ability very severely, but they constitute only a relatively small proportion of the total number.

The cases which present the most difficulty are those in which there are symptoms or general signs suggesting the presence of tuberculosis, but in which the physical signs in the chest are indefinite or obscure; or, on the other hand, those in which there is definite evidence of pulmonary disease, suggesting tuberculosis, in which the sputum remains negative for tubercle bacilli. In both of these types of cases it may be found necessary for the industrial physician to seek the assistance of someone who has had considerable experience in diseases of the chest and who has access to laboratory facilities which will aid him in establishing a diagnosis.

The method to be employed in carrying out entrance examinations is so well known that it is unnecessary to refer to it at this time. The periodic health examinations constitute more of a problem, the method of procedure varying with the size of the plant, the number of workmen that can be spared from work at one time, the medical equipment of the plant, etc. The frequency with which they should be carried out is also a difficult question to decide, as I have so far been unable to discover any accurate studies which would throw any light on this question. In very hazardous occupations it is customary to make examinations at frequent intervals, even every month; but in the average plant they are made at intervals of one, two or three years, according to the judgment of the medical officer.

The industrial plant with a medical staff of its own should experience no difficulty in making periodic health examinations, provided they were taken into consideration at the time when the medical staff was organized or provided the personnel is increased to permit their being made. They may be made continuously throughout the year, each employee reporting for reëxamination about one year from the time of employment and again each succeeding year, or it may be less disturbing to conduct an intensive study of all employees within a short period of time, preferably during the slack season. For the latter method it may be necessary to have the examinations conducted by some outside agency in order to avoid interfering with the routine medical service of the plant.

The plant which has no regular medical officer or only a part-time physician will find it almost impossible to have periodic health examinations made without the help of some outside agency unless the number of employees is so small that the part-time physician can make the examinations along with his routine work.

The need for some organized agency which could assist in the work of conducting health surveys and could serve as a group diagnostic center for obscure cases so impressed the Henry Phipps Institute that it organized such a team of examiners and established a diagnostic clinic for the use of industrial plants in and about

Philadelphia, the object being to provide a service which would cover all disabilities and not merely tuberculosis. The recent period of business depression seriously interfered with the health survey work, but the diagnostic clinic is now in operation and is handling cases from several large industrial establishments.

SUMMARY. In the foregoing paper I have attempted to give an outline of the tuberculosis problem as it affects the industrial worker. An unusual opportunity is here offered for the introduction of preventive measures, such as, for example, periodic health examinations, the results of which would be felt in the industries themselves, and, if sufficiently widespread, would have a beneficial effect upon the health of the public. The review of the subject has also made evident the need for a more carefully developed and more uniform method of statistical report.

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APRIL 28

Economic Inefficiency Due to Latent, Concealed Tuberculosis Affecting the Nervous Reserve

BY D. J. MC CARTHY, M.D.
AND
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Tuberculosis, as a disease entity, plays a greater part in industrial economics than any other disease affecting man. A statistical consideration of time and labor lost, as a result of tuberculous infection in humans, reveals some astonishing facts. It is roughly estimated from the records of the registration areas of the United States that approximately 160,000 people die annually from this disease and that the ratio of mortality to morbidity is as 1 is to 5. Therefore, there are annually about 800,000 persons sick from tuberculosis of one form or another. Reasoning from the purely economic standpoint of dollars, we might say that an individual's life is his capital and that his yearly earning power is the interest upon his capital. With a legal interest rate of 6 per cent on the earning capacity of 800,000 individuals, each of whom might in health earn at present, let us say, three dollars a day, we can readily see that the country loses in income, from the effects of tuberculosis, sufficient money to cover the combined expenses of supporting an army and navy of peace-time size.

The fundamental basis of a nation's prosperity is the productive energy of its people; the greatest of all our national resources is human labor and human intelligence, and inasmuch as 14 per cent of the deaths in our country are due to tuberculosis, it is no

exaggeration to say that the tuberculosis problem is one of the greatest of our national economics.

Only a small percentage of tuberculous individuals are brought under proper care at a period when a curative result can be expected. The present campaigning by state and city governments in educating the public and the physical examination of candidates for employment have cut down considerably the number of undiagnosed cases. The introduction of coöperative medical and social attention on the part of industrial organizations toward their workmen bids fair to result in a happy movement forward in controlling the situation. The satisfactory results obtained from factory and sanitation laws prove beyond question the relation that occupation and housing bears to the incidence of tuberculosis and that the crusade against the disease can achieve no great success if physicians alone are left to grapple with it.

The frequency of latent or concealed tuberculosis of the mildly active, chronic or the so-called quiescent form is recognized perhaps not too fully by the members of our profession. It is this class of patients which demands our utmost consideration. The inefficiency of workingmen who have this sort of infection is due not solely to any limitation of activity by presence of the local lesion *per se,* but to the toxic effect upon the organism in general, and particularly upon the central nervous system. This is exemplified, for instance, in one of the earliest evidences demonstrable in the activity of a tuberculous lesion, the nutritional disturbance effect upon the centers of heat regulation by the influence of physical fatigue shown by a moderate rise in body temperature after slight muscular or mental effort.

The normal individual, free from the drain of toxic absorptions, possesses in the aggregate a nervous reserve force which is at times remarkable. Everyone has what may be called a threshold value of nervous reserve sufficient to allow the enjoyment of an unconscious adjustment, which permits of each day being lived without special strain or loss of reserve over and above this threshold value. Each of us, when normal, possesses a reserve store upon which he can draw in such a way that any unusual strain of the

physical, mental or emotional demand will not overbalance the equation. But the individual who, by the constant battering of the central mechanism through the medium of a long-continued or intermittent toxic force, has gradually his threshold of safety raised in such a way that it approximates the peak ordinarily held by the total nervous reserve is due to live an unhappy daily life. He reaches the point where he cannot stand even the trivial demands, disregarded by the normal, without showing marked physical, mental or psychopathic phenomena.

It has been our experience in tuberculous cases to find that the usual attitude of these patients is not the happy one so commonly referred to in the text-books. On the contrary, this so-called *Spes phthisica* is, as a matter of fact, more frequently absent than present. With the almost constant expression of the symptom of loss of strength is associated various psychopathic symptoms, such as indecisions, lack of ambition, unnecessary worry, self-consciousness, lack of confidence, fears not founded on facts, and the more definite mental symptoms of loss of memory, absent-mindedness and inaccuracies in carrying out specific duties. Many of these factors are founded alone upon the effects of the tuberculous lesion upon the nervous reserve and mental forces, while others seem to be due to a secondary disturbance by the old tuberculous lesion upon the endocrine system, leading to a faulty defence and a consequent engrafting upon the already wornout mechanism of the effects of other intoxications. We have so often the expression of this end-result in many of our so-called nervous breakdowns, where the individual, realizing the faultiness of his defence, elects unconsciously to yield and break to the strain.

In looking over cases of this character which have come under our observation, we find numerous patients who express their economic inefficiency from the effects of tuberculosis on the nervous reserve in varying degree. Upon some there seems to be only a mild grade effect from disease of many years' duration, but we find that the majority of these cases are in every sense totally or almost totally inefficient for long periods of time.

One man, for instance, R. J., aged forty-one years, an overseer in a shipyard, showed a history of hemoptysis at the age of twenty-six, with only one month's disability. Now for months he has shown lack of ability to complete a day's work, unusual fatigue and discouragement. The findings here were healed apical lesions in both upper lobes with a recurrence in form of mild peribronchial activity and right base pleuritic involvement. This man is able to continue work of a modified character, but to do so is forced to spend all his nonworking hours in rest to regain the excess loss of physical and nervous reserve.

J. J., aged forty-nine years, at present a lodge secretary, with light mental duties, began life as a foundryman. In early life he showed unusual nervousness, marked self-consciousness and neurasthenia. At the age of twenty-one he had a nervous breakdown with disability for fifteen months. Two years ago he had an uncommon lack of energy, loss of self-confidence, inefficiency in performance of duties and various fears. In February, 1920, his daughter died of tuberculosis and the shock proved the breaking-point of his resistance. Examination showed him to have an old healed apical lesion with a recurrence of activity. His ability to work is now limited to but a few hours a day, the rest of his time being occupied in the care of his health.

With cases like these in mind we have before us also those of more serious moment and of infection more concealed in character.

C. B., aged forty-three years, came under observation in June, 1921, with symptoms of toxic neurasthenia. The significant factor in his past history was that at the age of twenty-three to twenty-eight, due to overwork as a secretary, he suffered an attack of nervous exhaustion. An examination of this man revealed a syndrome which we so often find typical of such cases. An unusually slender individual with flat, narrow chest, saddle-shaped abdomen protruding below the umbilicus from a coloptosis, slender extremities with large joints, flat-feet, low blood-

pressure and the pulmonary signs of an inactive apical lesion. This man was 6 feet 4 inches in height, weighed 144 pounds, with a maximum weight of only 155 pounds; systolic blood-pressure of 110, diastolic 80, with a tendency to stay stationary or slightly drop during the effort test. He had a slight leukocytic increase and a mild grade anemia. A diagnosis of asthenia on an old tuberculosis basis was made. He insisted upon continuing his work until, in a state of complete exhaustion, mental and physical, he had, in November, a severe coughing attack with a hemoptysis. At this time a small active spot was located at the area of the spine of the right scapula. Roentgen ray of the chest showed an old tuberculous lesion at the right upper lobe, with a spot of fine soft mottling of probable reactivity. He was hospitalized at once; remained in the hospital one month and then wanted to go to work. He compromised by going to the country under the supervision of a nurse, where he has since remained. During the past six months he has been spending two hours a day at his office without doing any actual work, and the probabilities are that it will be at least five months more before his nervous balance will have been regained sufficiently for him to accept responsibility.

On the other extreme we have the type who is consistently and wholly inefficient in an economical sense.

C. K., aged forty-two years, an artist, is classed by his associates as a neurasthenic. In early life he was reported to have been a very hard worker, although somewhat eccentric. In 1918, he came under observation because of a progressive indecision. He could no longer form definite decisions as to work or life-habits or, half-forming them, he had not the will to carry them out. He showed symptoms of nervous exhaustion in marked irritability, indecision, introspection and a tendency to be confused. His physical findings were old bilateral apical lesions, at least quiescent if doubtfully healed, with concomitant low blood-pressure, general muscular asthenia and arthritic pains, especially of the shoulder-joints. Since 1918, this man has been unable to

assume any duties and has barely been able to carry the burden of responsibility for his daily habits. At intervals, owing to his indecision, he attempts long journeys, and at these times it is not unusual for him to have attacks of hemoptysis; this is particularly true if in his journeys he crosses high altitudes. Following these attacks he becomes panic-stricken—goes to smash nervously and shows extreme psychic effects of struggle against known disease. Once in his career, in 1920, he decided to have a group study of his case and elected the Hopkins group. The final opinion there was a major diagnosis of psychasthenia on a basis of an old tuberculous chest with a possible factor of intestinal stasis. This man has made a dozen or more attempts at a beginning of professional life, only to fail in his start because of indecision and lack of self-confidence. He has been and will unquestionably be for a further period of time entirely inefficient economically.

In this manner case reports might be multiplied, but such would be tiresome. We have sought to select typical examples of the more important groups of latent or concealed tuberculosis involvements. While we have made no mention thus far of the association of tuberculosis to active mental disorders and true insanity, this discussion would be incomplete unless we bear in mind the large group of cases of adolescent insanity activated by a childhood tuberculous process or the group of individuals who, by the inheritance of a marasmic body from tuberculous parents, have, by failure of development during the first few years when active brain development principally takes place, an organism which is a precursor to a defective.

Considering that the cases discussed here occurred in men financially able to carry on until improvement shall have been accomplished, we turn a serious mind to the consideration of the thousands of cases occurring in a similar manner among the poorer classes and among the average working class. With a period of partial or total disability, ranging unquestionably on the average from one to three years, it must be clear that perhaps the majority of cases, often with their personal dependents, become subjects

of charity upon the states and cities. These people must devote the greater part of their time to the requirements of their health in order to hold the advantage gained by treatment. The economic inefficiency becomes multiplied by the disability of the individual and the necessity of society supporting most of the cases during this disability. Thus progress is greatly arrested and mental effort cut off prematurely by tuberculosis, a wholly preventable disease.

THE ACTION OF DIGITALIS IN CASES OF AURICULAR FIBRILLATION AND FLUTTER*

The Nathan Lewis Hatfield Lecture

Lecture IV

By THOMAS LEWIS
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The original observations upon which this lecture is largely based have been carried out by my collaborators and myself during the past twelve months to determine if the reaction of auricular fibrillation and auricular flutter to therapeutic doses of digitalis may be explained by the theory that these two disorders of heart rhythm are essentially due to circus movement.† First we will consider the action of digitalis upon the rate of the ventricle, and later we will consider the main problem of its action on the auricle. As will appear, knowledge of the first is relevant when we explore the second problem.

The Nature of Digitalis Block. The question as to how digitalis produces heart-block, the universally recognized cause of ventricular slowing in cases of auricular fibrillation, is one upon which a conflict of opinion exists. The evidence is not of so simple a character as it was once thought to be. The discussion is rendered of more consequence because precisely similar problems arise in

* Read May 5, 1922. Based on observations carried out on behalf of the British Medical Research Council.

† Especially associated with me in the most recent observations have been Dr. A. M. Wedd, of Pittsburgh, and Dr. C. C. Iliescu, of Bucharest; we have also received much assistance from Dr. A. N. Drury, who has for some years worked actively upon closely allied problems.

the case of ventricular slowings other than those due to digitalis and in other forms of slow ventricular action. The argument turns, as we shall presently see, mainly upon the reaction of the ventricle to atropine.

We start with the simple and uncontested fact that digitalis produces ventricular slowing in cases of auricular fibrillation, and we conclude from evidence in our possession that this retardation is due to block at the *A-V* junction.[8] Experiment teaches us that *A-V* block may be produced by digitalis in one of two ways, by increasing the tone of the vagus (an indirect effect exerted upon the junctional tissues) or by a direct action on the junctional muscle.[3, 11, 16] The action, whether direct or indirect, is exerted, according with the indications of recent experiment, upon that portion of the junctional tissues termed the *A-V* node.[11] The direct and indirect action each has the same end-effect; each produces a condition at the *A-V* node rendering it less capable of conveying impulses. The immediate effects upon the tissue are not quite the same; in the case of the nerve effect, we have to deal apparently with a reduced rate of recovery of the tissue; in the case of the direct action we have to deal apparently with a prolongation of systole, whereby the time allowed for subsequent recovery is reduced. Be that as it may the end-effects are both declared as lesser or greater degrees of block. Block at the *A-V* junction is the only known means by which digitalis can influence the rate at which the ventricle will respond to an auricle in a constant and unaltered state of fibrillation. Is this block produced by a direct action or by an indirect action through the vagus in clinical fibrillation? The problem would appear easy to solve. Digitalis slowing is produced in a case of fibrillation and the patient is then atropinized. The atropine paralyzes the vagus and the ventricular rate returns to about its former level. What more natural than to conclude that digitalis exerts its action through the vagus. That is the conclusion to which Mackenzie came,[12] when he first used atropine for this purpose. But, as Cushny[4] has very properly pointed out, the problem does not end here. Cushny's argument is one of some intricacy and has not been

understood widely and clearly. It may be illustrated diagrammatically (Fig. 1). Let us suppose that the line *cc* represents the level at which the ventricle beats in response to a fibrillating auricle when the patient is uninfluenced by drugs; and let us further suppose that this rate is reduced from *c* to *e* under the influence of digitalis given in therapeutic doses. Atropine is now given, and the rate returns, let us say, from *e* to *c*. The fall which digitalis produced is completely wiped out by the action of the atropine. Yet we are not justified in concluding that the digitalis fall of rate from *c* to *e* is vagal in origin. As Cushny has shown, if an

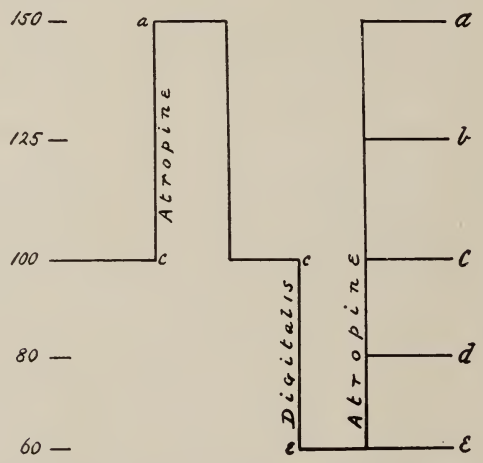

Fig. 1.—A diagram of the reaction of the ventricle, in auricular fibrillation, to digitalis and atropine. The diagram illustrates the text description.

initial dose of atropine is given in the predigitalis stage, the rate is lifted temporarily to *a*. In other words, the original level *c* was maintained at a comparatively low point by normal reflex vagal tone; and when this level is further reduced (to *e*) by digitalis, the subsequent rise produced by atropine may be attributed to one of two effects: (1) To the abolition of the original reflex vagal tone prevailing at level *c* and still maintained after digitalization, or (2) to the abolition of a digitalis vagal tone.

To obtain *proof* that the fall on digitalis is due entirely to an increase of preëxisting vagal tone, one view which has been held

of the action of digitalis, it would be necessary to show that atropine can raise the rate of the digitalized heart from level *e* to level *a;* for atropine, given in a sufficient dose to completely paralyze the vagus, should abolish, not only the original reflex vagal tone, but also that portion of the final vagal tone which has been superadded by the digitalis. The view may be held justifiably that the rise from *e* to *c* under atropine, is due, as was the original rise from *c* to *a*, to the abolition of normal reflex vagal tone and that the fall from *c* to *e* under digitalis was in reality the effect of a direct action which has been uninfluenced by the second dose of atropine. The level (*c*) at which the ventricular rate stands after digitalis and atropine is far below the level (*a*) at which it stands under atropine alone, and this should not be the case, providing that the digitalis fall is purely vagal, and if a dose adequate to abolish all vagal action is given on each occasion. Thus, it is evident that the final rise under atropine from *e* to *c* cannot be used as proof that the action of digitalis is vagal.

On the other hand it cannot be used as proof that the action is purely a direct one, the second view of digitalis action which has been held. *Proof* of a purely direct action would be obtained only if the second and adequate dose of atropine failed to produce a rise, namely, if the level remained stationary at *e*. It may be argued that since the rise from *e* to *c* is no greater than the rise from *c* to *a*, this relation constitutes evidence that both these rises are due simply to the abolition of the original reflex vagal tone, and that digitalis vagal tone plays no part in the fall *c* to *e*. This argument is only valid if a certain measure of vagal tone produces equal falls of ventricular rate from different initial levels and if we can be sure that when the ventricle slows under digitalis *the original measure of reflex vagal tone is maintained;* but the first assumption is scarcely justified, since a halving of ventricular rate is produced more easily when the rate of the ventricle is initially high than when it is low, and a halving of rate at a high level means a much larger fall in the number of beats per minute than does halving at a lower rate. In respect of the second assumption it may be argued that, when the heart slows under digitalis, the natural reflex vagal tone would tend to pass into abeyance and might vanish entirely.

We are left therefore in this position. Proof of uncomplicated vagal action requires a lift of rate from *e* to *a*. Proof of uncomplicated direct action requires maintenance of the level at *e*.

Now, neither one nor the other form of curve characterizes the actual reaction. The rate does rise when an adequate dose of atropine is given, but it rises to very different levels in different patients. In the series described by Mackenzie and by Cushny, the rise was generally either to a level intermediate between *e* and *c* or actually, as in Mackenzie's case, to *c*. It will be clear that the less the rise, the more is a direct action evidenced; the greater the rise, the more is vagal action evidenced; but that, so long as there is a rise, but a rise which fails to reach level *a*, *proof* of an uncomplicated action, direct or indirect, is not forthcoming.

The Dose of Atropine. The assumption that the dose of atropine given is adequate completely to paralyze the vagus is one of such consequence to the argument that it needs to be explored in some detail.

Actually the dose required to paralyze the human vagus has not been ascertained either for normal subjects or for cases of fibrillation, digitalized or undigitalized. The general assumption appears to be that one-fiftieth of a grain of the sulphate given hypodermically is sufficient.

This assumption appears to be based in part upon the belief that atropine has an "all or nothing" action; that if the ventricle is released at all, it is fully released. The last belief is not well founded. If atropine is injected intravenously repeatedly and in minute doses into dogs, it is not difficult to show that the drug first abolishes the effects of weak vagal stimulation, and that further doses are required before the effect of strong vagal stimulation disappears. In dogs weighing 10 kg. a dose of 0.2 to 0.4 mg. of atropine will abolish the effects of weak stimulation; in the same dogs doses of 0.4 to 1.0 mg. are required to abolish the effects of strong stimulation. The dose required to produce complete paralysis is approximately 0.05 to 0.1 mg. of atropine per kilo body weight. Calculated on the same bases for a human subject of 75 kilo weight,

the dose required would be 3.7 to 7.5 mg. (or approximately one-seventeenth to one-ninth of a grain). From this calculation it might be anticipated that one-fiftieth of a grain given to the human subject would on direct tests prove to be inadequate. At the same time it should be noted that while in dogs doses of from 0.2 to 0.4 mg. will not abolish all reaction, yet they very notably reduce the reaction to strong stimulation of the nerve. Thus, it is to be inferred that since one-fiftieth of a grain given to a patient is sufficient to produce a conspicuous rise of ventricular rate, a large subsequent rise of rate on completely saturating the vagus with atropine is not to be expected.

Clinical Observations. With few exceptions the dose given in published cases has been one-fiftieth of a grain of atropine sulphate administered hypodermically. In one of Cushny's cases one-fiftieth of a grain was administered on one occasion and one-twenty-fifth of a grain on a second occasion, the ventricular rate rising to approximately the same level on the two occasions.[4] It has been felt that this single observation, from which it is argued that one-fiftieth of a grain is an adequate dose, constitutes insufficient evidence; in a preliminary series of observations upon three cases of auricular fibrillation, we gave separately and at suitable intervals doses of one-twentieth and one-tenth of a grain with a view to comparing the resultant ventricular curves. In two cases no difference was apparent; in the third case the rise with the one-tenth of a grain was appreciably the higher. In a second series of observations upon similar cases we have given one-fiftieth of a grain of atropine hypodermically, and have followed this by a further and intravenous injection at the height of the reaction to the first dose. The results are variable. In some few patients one-fiftieth of a grain given hypodermically appears to be adequate. More frequently, however, the rate rises further on the second dose (Figs. 2 and 3). The second rise amounts to as much as 10, 15 or 20 beats per minute. Through and through this added rise seems to be greater in patients who have previously been brought under the influence of digitalis. That is to be expected if we take the view that a dose adequate to cut out normal reflex vagal tone is

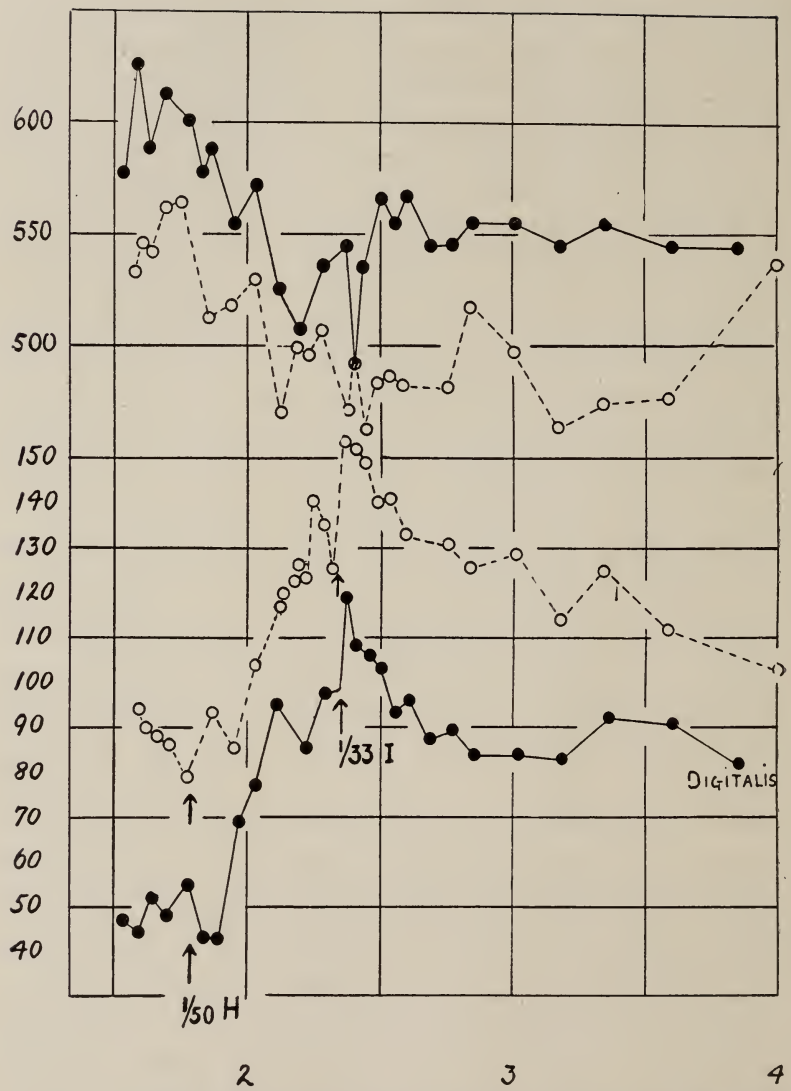

FIG. 2.—A chart of the auricular (upper curves) and ventricular rates (lower curves) in a case of fibrillation of the auricles. The curves were constructed from the patient while digitalis free (plain circles) and while under digitalis (black circles) $7\frac{1}{2}$ drams of tincture had been taken in eight days. In both circumstances a hypodermic dose of $\frac{1}{50}$ of a grain of atropine was followed by an intravenous dose of $\frac{1}{33}$ of a grain.

not necessarily adequate to abolish this tone and also that which we might suppose added during the period of digitalis slowing.

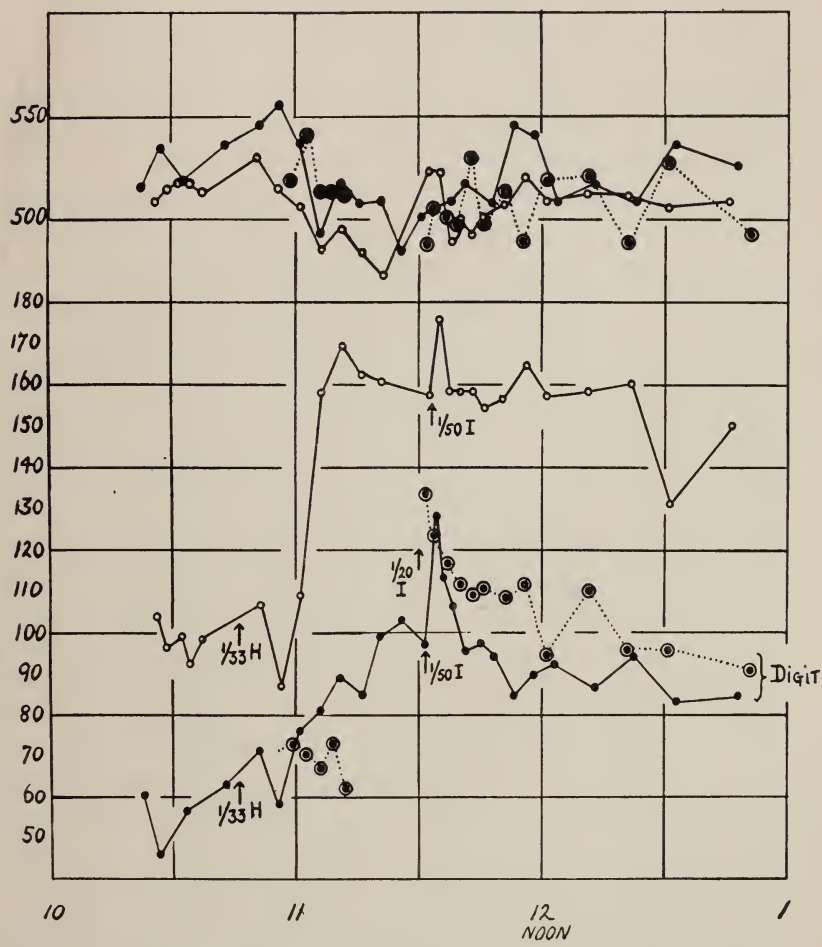

FIG. 3.—A similar chart from a second patient to which has been added the curve produced by a single intravenous dose of $\frac{1}{20}$ of a grain of atropine (double circles) while the patient was still under digitalis. The hypodermic injections in the case of the first curves were $\frac{1}{33}$ of a grain and the intravenous doses were $\frac{1}{50}$ of a grain. $9\frac{1}{2}$ drams of tincture of digitalis had been taken in eleven days.

Thus it would appear that the doses used to test the measure of vagal tone in both the digitalized and undigitalized case have

not always been adequate. The curves published by Mackenzie and Cushny to illustrate the effects of abolishing vagal tone in digitalized patients cannot be regarded as wholly representative.

When fuller doses, single doses of one-tenth or of one-twentieth of a grain, or two doses bringing the total to one-twentieth of a grain, are administered, the rise is almost always above the level of the predigitalized rate (level *c*); often it is considerably above this rate and exceptionally it may approach very closely to the rate obtained by the similar administration of atropine in the predigitalis stage (level *a*). Of the two procedures the former appears to be the more effective (Fig. 3), and presumably this is so, because when a hypodermic dose is given the reaction is not usually at its height for twenty minutes, while if a similar intravenous dose is given, recovery usually begins before this time has elapsed. It is to be concluded therefore that the full effect of one-fiftieth of a grain is not always shown when the drug is given hypodermically. In one patient (Fig. 4) the original rate was 101, and atropine (one-twentieth of a grain) drove the rate to 232. The patient was now given full therapeutic doses of digitalis and the rate fell to 70; a dose of one-twentieth of a grain now increased the rate to 205. The first atropine rise was of 131 beats, the second of 135 beats. It is to be observed that the full rate of 232 was not attained at the second injection, consequently it cannot be concluded finally that the digitalis slowing in this case was of purely vagal origin; but it can be concluded with some approach to finality that in this case the digitalis slowing was in large part vagal in origin, for the second dose of atropine almost abolished, not only the fall on digitalis but also the preëxisting reflex tone. The differences before and after the administration of digitalis was one of 31 beats per minute; the difference in the maximal rates attained under atropine was 27 beats. These two differences cannot reasonably be regarded as equivalent; the first, occurring while rates of 200 or over prevailed, is a minor difference as compared with that obtained at rates of 100 and under.

In view of such observations it seems reasonable to conclude that in some cases of auricular fibrillation, digitalis does exert an

influence through the vagus and that in greater or lesser measure this increase of vagal tone is responsible for the ventricular slowing. It still cannot be concluded that in any patient the fall of rate

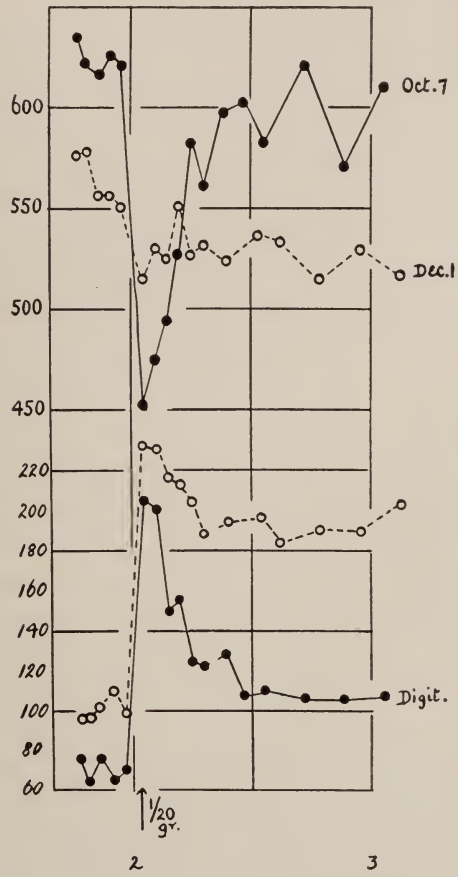

FIG. 4.—The effects of injecting $\frac{1}{20}$ of a grain of atropine intravenously in a case of auricular fibrillation, before (plain circles) and after (black circles) bringing the heart under the influence of digitalis (9 drams of tincture in twelve days).

is wholly vagal; neither can it be said that an increased vagal tone is present in all these patients during digitalis slowing, observations are still insufficient to determine the percentage of cases so influenced or the precise degree in which the two factors

are called into play. To embrace all cases of auricular fibrillation, our conclusion must remain tentative. We may sum up by stating that in the light of experimental and clinical observations it seems clear that digitalis exerts a twofold action, a direct and an indirect one, both of which decrease the facility with which impulses are conveyed across the *A-V* junction; both of which therefore reduce the rate of the responding ventricle. A similar conclusion has been reached by Robinson and Wilson,[14] arguing from experimental data, and by Cohn,[1] who argues mainly from clinical data. The proportion in which these two actions are exerted is probably variable in cases of fibrillation of the auricle; in some cases the vagal action appears to be the more conspicuous factor; in others, very probably, the direct action is predominant.

The importance of these conclusions will become more evident when we study the action of digitalis upon the auricle in auricular fibrillation.

Action upon the Fibrillating Auricle. Generally speaking it has been assumed that in cases of auricular fibrillation, exposed to the influence of digitalis, the auricular action remains constant, and that the whole effect upon the ventricular rate is localized in the junctional tissues. This is not strictly true; for the auricle is also affected. The action is not an entirely constant one, but in the majority of patients the oscillations recorded from the auricle are decidedly increased in rate (Figs. 2, 3 and 4). This change is studied in curves taken by means of direct leads from the chest wall, in which curves the electrical events in the auricle are represented in a comparatively pure form. Of 11 cases investigated, the oscillations showed no appreciable change of rate in 3 cases; in 1 case there was a fall of rate; while in the remaining 7 cases there was a decided or conspicuous rise of rate; in 2 cases the rise amounting to 60 or 70 beats per minute.

To what is this usual rise of rate due? To answer this question we must clearly understand the nature of auricular fibrillation. This mechanism, according to the theory we support, is the result of a continuously circulating wave in the auricle. The circus movement controls the rate of the auricular oscillations, each oscillation

corresponding to a complete auricular circuit. The time in which these circuits are completed actually depends upon two factors, (*a*) the length of the path followed and (*b*) the rate at which the wave travels. But the length of path is itself controlled by the length of the refractory period at any one point in the muscle and by the rate of conduction. Consequently we may say that the time in which a circuit is completed is controlled by two factors, namely, (1) the length of the refractory period and (2) the rate of conduction. As the rate of the oscillations per minute is due to the duration of individual circuits, it will be evident that the rate of oscillation is controlled by the same two factors.

A lengthening of the refractory period, by lengthening the path, will tend to increase the duration of each circuit and will slow the oscillations. Conversely, a shortening of the refractory period will tend to accelerate the oscillations.

Slowing of conduction will lengthen the circulation time and decrease the rate of oscillations; quickening of conduction, will increase the rate of the oscillations.

Now digitalis has two effects on the heart muscle. Insofar as it acts by increasing vagal tone it will reduce the length of the refractory period and it will tend to increase the rate of conduction. Thus, a vagal action of digitalis theoretically will reduce the time of circulation, will increase the rate of the oscillations. In experiment, vagal stimulation is well known to exert this influence upon the oscillations of a fibrillating auricle.[10 15]

On the other hand, digitalis, acting directly on the muscle, increases the length of the refractory period and retards conduction.[11] Theoretically, this direct action will increase the duration of the circulation time and slow down the oscillations. In anesthetized dogs, when a drug of the digitalis group is given, the vagal part of the drug's action is usually little in evidence, the chief action is a direct action. In such, the injection of the drug tends, as is expected, to slow the oscillations of the auricle which has been forced to fibrillate.

It is to be remarked that, when we are dealing with the rate of ventricular beating, both the direct and indirect actions of digitalis

are exerted in the same direction, *i. e.*, toward ventricular slowing. But in the case of the fibrillating auricle, the direct and indirect actions are opposed to each other, and may in large part neutralize each other.

Because in actual observation we find it to be the rule that the auricular oscillations are increased in rate, it seems impossible to avoid concluding that the predominant action of the drug is through the vagus, so far at least as the auricle is concerned. The nature of the *A-V* block resulting from digitalis has been discussed and the observations of Cushny have been revised, mainly because, if his conclusion that this action is purely a direct one in cases of fibrillation of the auricle is correct, it would stand in conflict with what appears to be the inevitable conclusion in the case of the auricle itself. The revision of his work on the ventricle has led us to a conclusion which is compatible with the observations upon the auricle. Both the direct and indirect factors come into play. Just as in the case of the ventricle, so in the case of the auricle, the proportion between the direct and indirect actions is variable. In the case of the auricle, in virtue of the fact that the two effects of digitalis are manifested in opposite directions, it is an easier matter to ascertain their proportion than is the case with the ventricle, where the two effects are manifested in one and the same direction. An increase in the rate of the auricular oscillations, which appears to be the rule, signifies predominant vagal action; a decrease, which is sometimes seen, indicates a predominant direct action; unaltered rate indicates a balance between the two influences.

Conversion of Flutter into Fibrillation by Digitalis. In 1911 Mackenzie[12] reported two cases of paroxysmal tachycardia, in both of which digitalis appeared to exercise a beneficial effect. The tachycardia, in each case of obscure form, gave place to fibrillation of the auricles under digitalis, and subsequently a normal rhythm was resumed. In the first of these cases, historically the more important of the two, I took electrocardiograms from the patient during his period of tachycardia. These curves I was at the time unable correctly to interpret, but they were published in Mackenzie's paper.

In the following year I was able to report upon a similar case in which a long-continued tachycardia was converted by the action of digitalis into fibrillation of the auricles with a subsequent resumption of the normal rhythm;[7] and was able to identify the original tachycardia of this case with those previously reported by Hertz and Goodhart[5] and Jolly and Ritchie,[6] and termed by the latter writers "auricular flutter." The observations upon this case further enabled me in the same article to place a final and correct interpretation upon the case reported by Mackenzie; it became evident in the light of the new case that Mackenzie's case had also been one of flutter. A series of cases in which a similar reaction to digitalis was observed was reported at a later date[9] and was soon followed by confirmatory observations by Ritchie[13] and others. The curious reaction, by which flutter of the auricle is converted to fibrillation, soon became well known and is now widely recognized. So far, however, it has not been explained.

The chief differences between clinical flutter and fibrillation, which have as yet been established, are that in the last condition the oscillations are more rapid and that they have not the regular incidence of those seen in flutter. According to our views the first difference may be interpreted to mean that the circuit movement is completed more rapidly, the second difference is due to irregular conduction in the case of fibrillation. What is the underlying cause of these differences? On this question it is still impossible to speak with certainty. The rapidity with which the circus movement is completed in fibrillation may be due either to more rapid conduction or to a shorter path.

It is very difficult to assume the first for several reasons. In general, the more rapidly an auricle beats, the slower will its tissue conduct, so that actually we should expect fibrillation to be associated with slower and not with faster conduction. If we were dealing with fibrillation in one patient and flutter in another, this argument would lose much of its force; but we have to face the fact that both flutter and fibrillation may occur as stable mechanisms in one and the same patient, under surrounding conditions which appear to be identical. Thus flutter, which has long been stable,

may be converted into fibrillation by digitalis, and this may and often does continue as a stable mechanism, long after the action of digitalis has passed away. The reverse change may sometimes be accomplished by the use of quinidine. It is difficult to believe that the rate of conduction (at a given rate of beating) is permanently altered as an after-effect of administering one or other of the drugs. A second argument against faster conduction in fibrillation is the irregularity of conduction, such irregularity being known to result when the conduction power is pressed to its utmost and is at its slowest. We are, therefore, probably correct in assuming that conduction is slower in the fibrillating auricle than in the fluttering auricle; but this difference fails to explain why the rate of oscillation is higher in fibrillation than in flutter; we turn to the alternative.

Does the difference consist in the length of path followed, the path being shorter in fibrillation than in flutter? Here again we have no direct and conclusive evidence, but there is some which is very suggestive. If we exclude faster conduction in fibrillation, then a shorter path may be due to shortening of the refractory period, it being assumed that in fibrillation the crest of the circulating wave always follows closely on the wake of retreat; in these circumstances the actual length of path would be controlled by the length of the refractory period, the wave at once entering muscle in which recovery is expedited. This view, that the refractory period in fibrillation is less than in flutter, has been put forward already by Rothberger and Winterberg, for it is consistent with the known relation between refractory period and rate of beating, the former becoming of shorter duration as the rate rises.

The path in fibrillation may be shorter than in flutter for another reason. In the first condition we conclude that the gap between the crest of the wave and its wake is a very short one; and we come to this conclusion because conduction is irregular in fibrillation and the path varying. In flutter, on the other hand, the rate of conduction is constant and the path unvarying; this difference in the two mechanisms is consistent with the view that while the gap is short in fibrillation it is longer in flutter; the wave

would then enter tissue in which an appreciable time for recovery has elapsed, whereby recovery of the tissue functions is carried further and to a more uniform point. Now a longer gap, other conditions being equal, would mean a longer path and a slower circulation time. Thus the essential distinction between fibrillation and flutter may consist in the length of the gap. This assumption would certainly seem to explain the observed differences between the two disorders.

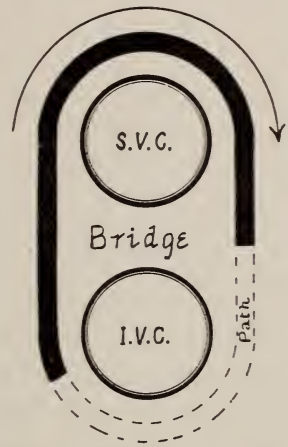

FIG. 5.—A diagram of circus movement around the superior and inferior vena cava, to illustrate how, when an appreciable gap exists, the wave may be unable to pursue a shorter course between the cavæ, unless the refractory period shortens. The diagram and its explanation suggest why the passage of flutter to fibrillation, or the reverse passage, should be an abrupt one.

If we accept this idea as a working hypothesis, it follows that the path travelled in flutter is compulsory to this extent, that the head of the wave is unable to make a short cut and thus to approach more closely to its own wake. To explain this conception in more detail, imagine the wave in flutter to be circulating around the mouths of both superior and inferior vena cava (Fig. 5). Such a circulating wave may exist in a stable form although a considerable gap exists. It cannot take the short path between the two cavæ, for whenever its crest reaches this muscle bridge, it will find muscle on this cross-route refractory. But supposing that this

is the state of affairs, and at a given moment the refractory period of the muscle shortens; the bridge may then be passed and the wave will then circulate, with a much shortened gap, around one or the other cava. The circulation time will decrease and, as a consequence, the refractory period will shorten a little more, tending to secure stability in the new mechanism, even when the original influence which shortens the refractory period is withdrawn. But as the gap is now smaller, conduction will tend to be more irregular and a little slower. In some such fashion it seems probable that the change from stable flutter to a more or less stable fibrillation may be produced.

Support is given to this argument by the change from stable fibrillation to stable flutter under quinidine. Hitherto, the significance of this change seems to have escaped notice. If the quinidine is given to these patients, a state closely resembling what we formerly termed flutter is always brought about, and this has been noted by several workers; but that is not the whole story. Usually the state produced is in reality impure flutter and this disappears invariably when the quinidine is withdrawn and its temporary effects on conduction and refractory period disappear. But in one patient in ten or more, pure flutter becomes established under quinidine; if now no further quinidine is given, the flutter does not disappear, it remains as a stable condition.

In the period of quinidinization, the refractory period is lengthening out and the rate of oscillations is falling. There comes a time when the reaction is at its height and the refractory period is at its longest; it is at this stage that pure flutter appears. We withdraw the quinidine and, as experience tells us, the refractory period recovers after a few (twenty-four to forty-eight) hours. Simultaneously any effect which the drug exerts on conduction must disappear. Thus, although both factors which tended to produce slowing of the oscillations disappear, little acceleration is apparent. A second and new condition of stability is reached. There is here little escape from the conclusion that the circuit contains a longer gap; such a gap must appear as recovery takes place without a corresponding speeding up of the movement. If similar doses of

quinidine are repeated on this same patient when the flutter has become quite stable, considerable doses may be given without appreciably affecting the rate of oscillation. There is some slowing, but this is minor in its degree and is to be attributed to the effect of the drug on conduction alone. It is comparable to the slight acceleration which occurs before the flutter becomes stable, a change due to improved conduction following withdrawal of quinidine. The delay of a pronounced fall in rate when the auricle is fluttering is due to the period occupied by closure of the gap by the lengthening refractory period.

Thus, we may conclude that one essential difference between flutter and fibrillation is that the gap is longer in the former.

We now return to the original question; and ask why digitalis converts flutter into the faster-moving fibrillation? Whether the reply is that it must quicken conduction, or whether the reply is that by reducing the refractory period it shortens the path upon which the wave circulates—and the latter is the more promising hypothesis—the explanation of its action will take the same direction; it will be necessary to assume that the quickening is due to a predominant action through the vagus nerve. Just as we explain an increased rate of oscillation in fibrillation itself consequent upon digitalis, so we explain the conversion of flutter in fibrillation; the vagal component of digitalis action will alone induce those changes in the muscle which are theoretically necessary to bring about the quickening which occurs. If you so desire, you may treat the question more upon the lines of direct observation. A material increase of vagal tone quickens the rate of experimental flutter and eventually may force it into fibrillation;[10 15] actually the effect of the direct action of a digitalis body upon flutter has not yet been observed, but we can predict that it would not quicken the movement, for in experiments on dogs, under certain conditions of anesthesia, in which the direct action is alone displayed and the auricles are fibrillating, quickening does not occur; on the contrary, slowing is often seen.

We need therefore have little hesitation in concluding that the conversion of flutter into fibrillation by digitalis is essentially vagal in origin.

The Influence of Auricular Quickening upon Ventricular Slowing under Digitalis. As stated, it has generally been assumed that when the auricles are fibrillating, the effects of digitalis upon the ventricle result simply from heart-block. This assumption is not in the strictest sense justified; for it is the rule to find that when the ventricle slows, the auricular mechanism also changes; in greater or lesser degree the movement quickens, and this quickening will exert some influence upon the rate of the ventricular response. Experiments bearing upon this point of view show that at fast rates of beating an increase of rate in the auricle tends in itself to lower the rate of ventricular response; it favors block. The degree in which this influence is responsible for the ventricular slowing cannot be considered in detail on the present occasion. It must suffice if I say that, considering the relatively small change of rate which occurs in the auricle, we do not consider the influence to be a very material one at the rates prevailing.

It is to be noted also that atropine when given in cases of fibrillation produces a fall of auricular rate. This fall of rate will in a small measure favor a rise of ventricular rate, usually attributed entirely to removed vagal tone; the fall of auricular rate is usually small, and is not very materially different in digitalized and undigitalized cases; so that this effect has been neglected in the argument of this article. The magnitude of another factor in the action of atropine is less certain; in experimental fibrillation, if strophanthin is injected and produces a little slowing of the ventricle by a *direct action* rather than by a vagal action, an event which often occurs in dogs under full anesthesia, then a full dose of atropine does not increase the rate of the ventricle but may appreciably *decrease the rate.* If digitalis acted directly upon the muscle in man, and only directly, it seems probable that a similar decrease of ventricular rate with atropine would sometimes be seen in patients; actually this is not the case.

A final word completes what I have to say: It seems to us that the more we explore the facts and view them in the light of the theory of circus movement, as the fundamental cause of flutter and fibrillation, the more clearly is our whole knowledge of flutter

and fibrillation illuminated. We cannot believe that the theory would be found to offer a reasonable interpretation of so many and such diverse phenomena unless it were fundamentally true.

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MEDICINE OF THE HUMANITIES[1]

The S. Weir Mitchell Oration

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NEW YORK, N. Y.

The incidents of the career of Dr. S. Weir Mitchell, his character and life-work, have been fully and admirably dealt with both by my predecessor and in the "Memorial Volume" published shortly after Dr. Mitchell's death, so that it seems to me I could better devote my time to a study of some of the lessons which the life, influence and character of Dr. Mitchell teach us.

I had known Dr. Mitchell from the early part of my professional career, but not intimately; and in my feelings for him there was at first a touch of awe (which gradually became one of pride) for the things which he as a doctor had accomplished. Still later this feeling was increased to one of real warmth and friendship through an accident, which he probably thought befel as a matter of course, but which gave me a new insight into the depth and range of his sympathies. I had suffered a bereavement which left me rather stunned. A few days later I received a letter of most kindly sympathy, and a little book of poems called *The Comfort of the Hills*. I had grown up in the comfort of the hills and his letter and gift made me look upon Dr. Mitchell in a new light and with feelings not only of gratitude but of affection. He did not know me then well enough to realize how much good his message did me.

This attitude of warm and friendly admiration was widespread

[1] Read November 23, 1922.

and even international. The fact was once brought to me with dramatic emphasis. Nine years ago, at a meeting of the International Medical Congress in London, we had a large dinner, attended by the neurologists from all over Europe, and I was allowed the honor of speaking for America. I dwelt on the fact that in the early days of American neurology we men of the younger group had some supermen to help us, and I mentioned the prominent men of the '70s, '80s and '90s. When I came to the name of Weir Mitchell, there was a loud and spontaneous burst of applause. It rather startled me, as well as pleased me, and it showed, as I thought at the time, that Dr. Mitchell throughout the world was in a class by himself.

I presume and hope that Dr. Mitchell had some of that particular quality, I will not say vanity in but enjoyment, of formal recognition, such as most of us possess. If he did, he must have derived much pleasure from his achievements. His contributions to scientific and practical medicine were many and were acknowledged to be far-reaching and enormously helpful. He contributed to laboratory work, as well as to clinical medicine and therapeutics. He changed and added to methods of medical practice. But in particular he showed the value of the personal equation, in applying our art in practice. Without hunting for buried and sodden complexes, he found and routed them out, by his compelling skill. He accomplished psychoanalysis without stirring up the muddy depths of a Cimmerian past; he was the father of the best modern phases of psychotherapy and in particular he showed how much the non-technical side of the physician and his cultural values have power to accomplish.

You know Matthew Arnold's often quoted statement to the effect that two-thirds of human life have to do with problems of conduct. I would say that it is even more true in medical practice that two-thirds of efficiency and success depend on conduct and character, and hardly one-third on technic.

Weir Mitchell's career illustrates this; and it has a value to students of medical education as well as to those of the profession who have high ambition for their art.

The Humanities and Technic

The whole trend of modern medical education now is to enlarge and emphasize the technic and to ignore the human. I have almost yearly had to assure my medical classes that they were as yet persons without souls, because they would insist on laughing at the awkward movements or unintelligent expressions of my neurological cripples displayed before them. I assured them that if they would be quiet or even shed tears at the time of these incidents, they would add some cubits to their moral statue and beget qualities that would make them better physicians. They then would behave better. In fact, the medical student is open-minded to cultural things and would be glad, I am sure, if he were taught a little less technic and more of the humanities.

The word "culture" has become a thing of which the younger generation is a little shy—perhaps because it has been spelt with a "K." But as I understand and use it, the term means that a person with culture has enough knowledge of the present-day world and of what has been done in the arts and learning of the past to have a background. One cannot always or easily tell when there is a background of character, but we all know those people without it. They are of a narrow intelligence, commonplace in thought, without humor, poor in their judgments, and prone to hold foolish and fanatical beliefs. These are the supporters of our medical cults, and back of their activities are usually misapplied emotions.

Weir Mitchell, without ever losing his laboratory habits or scientific methods of thought, could not only acquire but also contribute cultural interests to all those with whom he came in contact.

Stimulated and instructed by his career, I have felt that I would like to urge the medical schools to organize non-technical courses at the expense of learning less of the specialties, at least in the undergraduate school. I am aware that, to an extent, colleges are driven to this diffuse technical teaching by the requirements of State boards. This, however, is not a phase of my

subject on which I shall dwell at present, for I am interested this evening first in trying to demonstrate that something may be put into medical education (besides the technical studies) which will promote efficiency, usefulness and happiness throughout the whole course of the doctor's career. One of the things which a doctor should start with and pursue all his life, is some brand of this thing I call "culture."

Now a person can possess this without knowing the humanities; but a knowledge of these, as I use and understand the word, will also surely give something of this pragmatic culture for which I am pleading.

The terms "Humanism" and "The Humanities" began technically with Petrarch and blossomed out very dominantly in the sixteenth century. A study of the humanities at that time meant a study of all the established writings of the great men of the past, and excluded only theology. Later the term grew to have a wider meaning. Petrarch himself had the cultural qualities of love of the classics, not of the books alone, but of the men. Writers like Virgil and Horace were to him real, living characters, and he himself loved not only letters and art, but human beings. I would include under "culture" the study, knowledge and sympathetic appreciation of the best things thought and said and done in the history of mankind, the well-written stories of the achievements and mistakes of the great periods in human progress. In fact, the word, as Hazlitt used it, meant all interests which, though non-vocational, at the same time involve acquaintance with things of established beauty or worth.

If a person has something of this sort of culture, he will be likely not only to possess mental balance but also show sanity in his ideas and beliefs. It is because of a lack of this non-vocational education in America that we are preyed upon by a continual succession of wasteful emotions, shown by the fads, follies and fears of the day. With all due respect to the dynamic psychologists, I would claim that a real, serious, simple, cultural training of our adolescents would clear the subconsciousness of irritating complexes and the activities of desire much more than intro-

spective studies of a morbid personal past. I am in favor of the study of the ripened works of the world's past, as a cure for and preventive of the misadventures of the developing personality. I would go back to nature or to the classic past, rather than to infantile memories.

In this we are in touch with Walt Whitman in his forceful utterance about introspection:

> I think I could turn and live with animals, they are so placid
> and self-contained,
> I stand and look at them long and long.
> They do not sweat and whine about their condition,
> They do not lie awake in the dark and weep for their sins,
> They do not make me sick discussing their duty to God.

Of course with this quality of character there must come some self-restraint, some serious and dull hours of work, repressions, inhibitions and even some uncongenial concentration. But I am sure the biologists agree, if psychologists do not, that life is made up of inhibitions, since every activity of our vital forces must be guided by some definite directing inhibition, in order to become practically effective. And education would not exist if there had been no enforced guidance of the developing mind. Surely no one has to have more inhibitions cheerfully sustained than a successful medical personality.

The Peaks in Medical Progress

I pass now from the subject of the nature of the "humanities" and their relation to the individual physician: And I wish to call attention to some facts in the history of medical and human progress which bear on these humanities. They are certainly interesting. I hope I am interpreting them with some justification. The data at least are correct; and the deductions will as I hope arouse attention with perhaps some helpful results.

Up to the sixteenth century there were just four peaks in the history of medicine; four periods when medicine received a distinct impetus. These were the great classic period of Hellenic culture at the time of Pericles; the period of activity of the

Alexandrian school; that of the second century of the Roman Empire, and that of the late Renaissance.

Real medicine began with that race which gave us the *Iliad,* Plato, Socrates, Aristotle and the great Greek tragic poets.

And medicine received a new and important impetus only at the later periods mentioned when at the same time the humanities were especially contributed to the world.

Let me say a word about some of the earlier periods and of other contributors to art, literature and civilization.

I have long been interested in the culture of the Chinese. They are a race which has been educated almost exclusively on its peculiar brand of "humanities" for three thousand years. I do not say it is cause and effect, but for some reason the cultivated Chinaman probably on what may be called the "sensory side" represents the most complete and perfect product of God's creative skill in the realm of terrestrial life. He is at any rate a very high type of the *genus homo.* This is shown in his capacity to create and appreciate beauty and the higher forms of sensuous appeal; in his attitude toward life and death and pain; in his power to adapt his social life to his capacities, his enjoyments and his needs. No nation except the Greek has ever produced art equal to theirs; nor has any nation so peculiarly perfected the art of living and of dying without complaint.

But the Chinese with all their classics added nothing to medicine. Was it not because these classics made no broad human appeal. They were the moral and behavioristic sayings of Confucius and Mencius with their followers, and the often beautiful and spiritual appeals of Buddha. All their utterances were concerned with conduct and especially with family life in its ethical bearings, or with a personal sublimation into Nirvana. They had their poets and artists and inventors, but all their classic literature was dominated by the ethico-religious doctrines. China never got outside itself; never had any but its own background; its poetry was descriptive; it never produced a great epic nor developed a world literature of classic value. And it added nothing to medicine, because its culture was not broad and not humane. The Chinaman was born chiefly to become an ancestor.

The same things may be said of the Babylonian, Jewish and Indian cultures. They were interested more in the stars, in their gods and in the soul (an interest which paralyzes); not in the objective study of nature and man. All that these nations ever gave to medicine were some public health measures from the Jews; some operative skill from India and, from various other sources, some of our materia medica. Egypt had a noble art, and an extraordinary and interesting civilization, but man was an incident in royal life or priestly ritual. The Egyptians embalmed but never dissected.

In all these nations the civilization was racial and specialized.

It was with the Greeks, then, at the period of their greatest literary, artistic and philosophic activity, that medicine really began.

The Hellenic Peak

It seems that a race had to be able to create great and enduring works in literature and art, in order to have the ability to see the importance of objective study and to attack with success the science and art of medicine.

Hippocrates was perhaps not one of the group that gathered in the groves of the Academy—at least he took no part in the Socratic dialogues; but he possessed the spirit of the humanists, for, as Mahaffy says, "We find even a literary grandeur in his prose that is not the writing of any but a great master." He had the vision to start with hygiene as the proper basis of medicine —thus beginning at a period at which we are just arriving. He sought to systematize experience by careful observation, to establish laws of hygiene and to utilize the natural prophylactics or remedies afforded by air, water and climate. He originated the famous oath which expressed the highest aims for the practitioner of physic and gives an ideal of conduct that cannot be improved upon today. This *Votum medici* could not have come merely from a medical technician, however well trained.

When Greece lost its independence a general decadence set

in. The school of Cos also began to decline and nothing was added to medicine from this source.

Then three centuries later the school of Alexandria became the center of learning and of literary activity, and also of the mechanical sciences and medicine. Here there developed a classic literature of a somewhat lower grade, but with peaks that rivaled earlier periods. The idyls of Theocratus, the poems of Callimachus and Apollonius, the contributions to the Greek anthology survive in literature today.

The Alexandrian Peak

Along with this literary renaissance flourished anatomy and medicine in a way they had never done before. Hippocrates was a clinician, not an anatomist or physiologist, but at Alexandria anatomy was studied and dissections were made. Not much has survived of Alexandrian work today, but we know that this school educated almost all of the physicians of Europe for the following five hundred years. We have much of its teachings probably in the text-book of Celsus, which was written in the first century and is one of the best works on medical practice that ever appeared. This was the fruit of the Hippocratic and Alexandrian peaks of medical progress, both developed in a period associated with a great devotion to what we call now the "humanities."

The Romans had their classic writers and no one can deny that Cicero, Virgil and Horace contributed to cultural literature. But they were almost exotics; the Romans loved money and power and had great skill in administration and the enactment of laws, but they had no interest in any form of natural science or objective study; and they despised medicine. At the time of Julius Caesar they simply began to tolerate it, but without contributing to it.

The Imperial Roman Peak

For one hundred years they gradually grew more civilized, and more cultivated.

Then:

"In the second century of the Christian era, the Empire of Rome comprehended the fairest part of the earth, and the most civilized portion of mankind. The frontiers of that extensive monarchy were guarded by ancient renown and disciplined valor. The gentle, but powerful influence of laws and manners had gradually cemented the union of the provinces. Their peaceful inhabitants enjoyed and abused the advantage of wealth and luxury."

I am sure you recognize in the foregoing, the sonorous periods of Gibbon.

This was a time when the eleven bad emperors who succeeded Augustus were all dead, most of them having been murdered, and the five good emperors were beginning their sway. It was a period when interest in the humanities rose as high as it ever could rise in a Roman civilization. Every educated citizen felt it proper to write poems, essays and orations. Even the emperors did this, and both Seneca and Lucan were the objects of imperial envy because they were cleverer than their masters. The popular thing from the time of Horace to that of Pliny Secundus was to gather a group of friends and read to them their effusions. These groups, as Pliny admits, sometimes got bored. Many of the wealthy had a professional literary slave to help them in their cultural toil. Every city of any importance had its writers and authors.

Even though the highest type of work was not done in this century, it is probable that no series of writings have affected educators, education and opinion in general more than those of this period. In law there was Quintilian; in medicine, Galen; in history, Tacitus and Plutarch; in philosophy and ethics, Epictetus and Marcus Aurelius; in literature, Martial, Juvenal, Persius, Pliny and Lucian.

The elder Pliny was stirred to an interest in natural history, and he incidentally made real contributions to materia medica, though he severely criticized the doctors, as they perhaps deserved.

It was at this period that Galen appeared, and his work made

the first real contribution to medicine since the active studies of the Alexandrian school. In Galen, again, we find the Hippocratic spirit of wishing to learn by observation and experiment. He used, again, the methods of the laboratory, and added definitely to anatomy and physiology. Galen was a man of surpassing industry and extraordinary learning; indeed, he seemed to know everything that was then to be known. He so much surpassed his contemporaries and successors and lifted medicine to such a high plain that he practically isolated himself, his science and his art. Due to Galen's influence, medicine remained upon a sort of intellectual platau for about one thousand years, and while the air of this plateau was stimulating and beneficial for a short time, it eventually became distinctly toxic. Galen's methods were forgotten, but his doctrines acquired a strangle hold on medicine up to the time of the sixteenth century.

The Sixteenth Century Peak

I wish I could introduce this period of time with a paragraph as eloquent as that of Gibbon when he wrote of the second century. The Dark and Middle Ages were not apparently contributing to human knowledge or progress, but they were fecundating, and they went into a strenuous but fortunate parturition in the fifteenth and sixteenth centuries. Civilization felt and found new forces and larger opportunities.

The new world had just been discovered, and there was an awakening to the knowledge of the Greek and Roman past, its historic deeds and its classic literature. Learning was becoming more human, theology was no longer queen of the sciences. Universities grew in number and teemed with students. The Medici flourished in Florence. Erasmus, Melancthon and Richepin spread the love of scholarship in England, Germany and France. Marguerite of Navarre had an intellectual, religious and amatory circle in France. Rabelais wrote his tales; Montaigne, his essays; Cervantes, his *Don Quixote*. There was a group of

learned men and wits in London, and there were also Johnson, Spencer and Shakespeare.

But there were also some dreadful things done: The Wars of the Netherlands, the sack of Rome, the Massacre of St. Bartholomew, the looting of Mexico and Peru, the religious wars and persecutions.

In spite of all these horrors the times were alive, and alive with eagerness for scholarly accomplishment, and finally also with zest for scientific research.

In this century medicine was born again. For it was then that Vesalius published his work, aided by the art of his day, and a real anatomy of the human body was given out for the first time in the history of civilization.

Paré reformed surgery; Paracelsus broke into the old academic methods of Galenical medicine; Servetus discovered the pulmonary circulation; Eustachius made an anatomy almost as good as that of Vesalius; Fabricius at Padua was teaching Harvey the method and spirit which led to his discovery of the circulation of blood; Linacre established a course of lectures at Oxford.

But I am not going to keep you in the sixteenth century; the story is a familiar one. The classical spirit had descended upon learning and mellowed the methods and opened the hearts of teachers and students.

I may not have convinced you of my view, that when a race or a civilization has humanism it begins to study medicine seriously and accelerate its progress; but I hope the thesis will arrest your attention and make you forget for a time the hero of today, Mr. Henry Ford, who thinks history is all "bunk."

After the sixteenth century medicine stood rather still for two hundred years, for from the sixteenth to the nineteenth nothing much was done, except some additions to chemistry and to the physiology of respiration. The period is full of interesting men and curious and ingenious theories; it forms a stirring record of individual activities, but not of medical progress.

The Nineteenth Century

During the nineteenth century, medicine really arrived, and since then we have been able to say that there is a medical science as well as art.

During the first half of this time Germany wandered about in a maze of enticing philosophies associated with a convinced nihilism as to the therapeutics of the medical art. Then she found herself. In England and France there arose groups of clinicians with powers of observation and interpretation not developed before or since. Jenner started the century with his vaccinations. Then and later came the Hunters, Stokes, Adams, Bright, Brodie, Laënnec and others whose names are identified forever with the recognition of special types of disease or significant and diagnostic syndromes.

The nineteenth century has been variously classified from the cultural point of view as mediocre and Victorian. Of late, however, both Victoria and her century have received the greatest respect. It seems to me that at least humanism and the humanities were definitely pervasive then. Indeed, it was in the early part of the century that Hazlitt revived the word and exploited its value with eloquence and emphasis. At any rate, I leave the historical phase of the subject and beg to be allowed to say something concerning its relation to the doctor's education and habit of life.

Medical Education

The thesis that I am expounding bears greatly on this subject. We all, I think, who have reached mature years like to have an opinion on education. And we have a perfect right, for there is really no established authority, no last word. Education is still an empirical subject and a fruitful field for opportunism. I am told that a much and justly celebrated educationalist visited Chicago not so long ago, and met an almost equally famous health officer of Chicago. The health officer greeted the educationalist most warmly: "You have done a great thing

doctor," he said; "you have wiped out fifty medical colleges and put a lot of cheap doctors out of business. Splendid! Doctor, you are the father of chiropractics!"

And so he is, although that was only an incident showing the difficulties and peculiarities of medical educational problems. I am not offering any solution, but I offer my small contribution. Medical education is a social problem as much as it is a technical one. I would urge the value of such kinds of a vocational study as help to make the doctor more human; studies which make him love his patient more than the disease, and realize that patients like being caressed rather than being diagnosed. This is forgotten—therefore we have the chiropractors.

A study of the lives of successful physicians and of the accomplishments and methods of the past shows often the value of this kind of interest. There is something instructive to medical educators even in the methods of the ancient medical schools and their products. Guy Patin was possessed of and by the scholasticism of his day, he wrote clever letters, but he was a good teacher and a good doctor, even though he only used bleeding, ptisans and senna. There was something fine, too, in the academic ethics of the past. After Jerome Cardan had signed his agreement to treat the Archbishop of St. Andrews for five dollars a day and a bonus, he tore the contract up, as it was unethical for a physician in his day to give his bond, when his word should be enough. I like the way in which by elaborate functions they of old emphasized the importance and dignity of the profession. They would not in the old days tolerate fads or cranks, even to the point of injustice. We need now to call a halt on our tendency to develop medical fashions. It happens at present that every obscure functional case has to be considered from the standpoint of the internal secretions, oral and colonic sepsis, or the subconscious. And we are apparently every day in every way getting more sympathetic to new fancies.

How is education going to handle these things? A popular view is that we should let the instincts have their play; open up the subconscious and do pluriglandular feeding. So far as I

can see, we can only handle these factors by educating people to have a background, and this means a wise development and training of our higher faculties. By obtaining through these such control that we can adjust ourselves to the conditions of life about us, or else change these conditions by our own activities, and thus make the environment adjust itself to us. The processes here are the acquisition of useful knowledge, technical and cultural, and the encouragement of power to inhibit the bad instincts and exploit the good ones.

The little red school-house has been a very efficient instrument in cultivating inhibitions, although it was a very rigid yardstick. How are we to acquire a useful and also humane knowledge? As far as medicine is concerned a friend of mine, an up-country doctor, said one day: "Why don't the colleges give a course in medical history, so the doctors will know what has been done in the world? Then we will not be running quite so much after what seems a new thing."

My own suggestion has long been that medical colleges should have an advisory historian, who will help the different departments to prepare historical lectures covering various fields or to step in and lecture himself. Something of this kind would I know, if well done, interest and stimulate medical students immensely.

I do not believe that all doctors need to be educated; certainly not too highly. Learning sometimes spoils the personality. A laboriously acquired education may definitely weaken the driving force and even the capacity for originality. A doctor who gets a good start on a limited original training may rise higher than his educated brother, but he will always become better and happier if as he progresses he acquires a knowledge of the humanities. Physicians who add something on the æsthetic side to their professional training are helped thereby. Doctors who have some sincere religious feeling and interest, who have some music or art as an avocation, penetrate more easily into the souls, bodies and even pockets of their patients.

It is my conviction that the study of the classics to the point where one knows them historically and somewhat linguistically

forms an avocation that combines intellectual training, enjoyable knowledge and distinct æsthetic values.

Weir Mitchell in his avocations was very nearly a genius. He did things which were classic of themselves and he must have gotten much technical help in the arts which he pursued and adorned.

Few can follow his methods or imitate his pursuits, but his life is testimony to the enrichment that comes from having a sound technical training and skill, together with the artistic accomplishments of a poet, an historian and a vivid narrator of appealing tales.

Dr. Mitchell wrote articles on the venom of snakes, on injuries of the nerves, on fat and blood, disorders of sleep, neuralgia, knee-jerks and neuritis, but he was also interested in the tombs of Lycia, one of the most obscure provinces of Asia Minor, but rich in antiquities. He wrote perhaps his best poem on a "Lycian Tomb," on which one and the same woman is carved in many attitudes of grief, each figure separated by Doric columns:

> "What gracious nunnery of grief is here,
> One woman garbed in sorrow's every mood,
> Each sad presentment set apart, in fear
> Lest that herself upon herself intrude."

This was in the most classical trend of his imagination. He also wrote in a modern and personal mood.

Very charming and human was his "Address of a Bottle of Madeira, aged eighty-six, to George Bancroft, aged eighty-six." There is in it a greeting and a goodbye, and though the lines are a trifle "wet," I will finish my address and say my goodbye by quoting the last three stanzas:

> Years eighty-six have come and gone;
> At last we meet. Your health to-night.
> Take from this board of friendly hearts
> The memory of a proud delight.
>
> The days that went have made you wise,
> There's wisdom in my rare bouquet.
> I'm rather paler than I was;
> And on my soul, you're growing gray.
>
> I like to think, when Toper Time
> Has drained the last of me and you,
> Some here shall say, "They both were good,—
> The wine we drank, the man we knew."

ANNUAL REPORT OF THE LIBRARY COMMITTEE FOR 1922

Mr. President: In accordance with the ordinances and By-Laws of the College, I herewith submit the following report of the Library Committee for the year 1922:

Total number of volumes in the Library, including the bound volumes and 19,985 unbound "Reports" and "Transactions"	136,489
Number of unbound "Theses" and "Dissertations" .	14,677
Number of unbound pamphlets	131,866

Included in the above are 4,144 volumes known as "Reserves," consisting of second copies of some of the more important periodical publications; also 2,913 volumes more or less incomplete.

The duplicates, which are not included in the above total, number 9,323 at this date.

The following table shows the number of volumes in the various divisions of the Library:

	Bound.	Incomplete and unbound.	Total.
General Library . . .	95,948	2,866	98,814
Lewis Library	13,738	44	13,782
On permanent deposit:			
S. D. Gross Library . .	3,688	3	3,691
Library of the Obstetrical Society of Philadelphia .	217	0	217
			116,504

Received during the year from all sources, 6,430 volumes, 10,418 pamphlets and 16,016 numbers of various periodicals.

Divided as follows:

	Volumes.	Pamphlets.	Journals.
General Library	5,596	10,290	15,494
Lewis Library	21	.....	.....
S. D. Gross Library . . .	43	.....	.....
By purchase, General Account	408	.....	.....
In exchange	362	128	522
	6,430	10,418	16,016

Accessions (including 316 volumes of "Reserves"): 4,044.

	Volumes.
General Library	3,980
Lewis Library	21
S. D. Gross Library	43
	4,044

Total increase in the number of volumes for the year: 4,044.

Photographs received in response to requests sent out during the past year and voluntary gifts:

Fellows, 10. For the War Album (Fellows of the College), 3. Other than Fellows, 79.

Total number of portraits listed, 10,505.

The individual "Donors" for the year ending November 1, 1922, number 412; this represents 955 distinct presentations. Each gift is duly acknowledged and properly recorded.

The following list shows individual gifts of more than twenty-five volumes, and the number of volumes presented by the various publishing houses:

	Volumes.
Dr. W. W. Keen	973
Pennsylvania Hospital	327
Dr. Francis X. Dercum	274
Dr. Lewis H. Adler, Jr.	234
Estate, Dr. R. A. Cleeman	162
Dr. M. W. Zimmerman	161
Dr. Daniel Longaker	143
Miss Marie Louise Seltzer	122
Dr. Williams B. Cadwalader	98
Estate, Dr. Edward J. Nolan	74
Dr. S. Solis Cohen	73
Dr. W. H. Githens	61
Dr. Charles K. Mills	54
Miss Minnie E. Applebach	32
Dr. John Speese	30
Dr. F. W. Berge	28

From the publishing houses of:

P. Blakiston's Son Co.	15
F. A. Davis Company	11
Lea & Febiger	22
Librairie Terquem	1
J. B. Lippincott Co.	19
W. B. Saunders Co.	40

The Library is indebted for large gifts of pamphlets and unbound periodicals to the following donors:

Dr. Lewis H. Adler, Jr.
Dr. A. P. C. Ashhurst
Messrs. P. Blakiston's Son & Co.
Dr. Charles W. Burr
Dr. Williams B. Cadwalader
Dr. A. A. Cairns
Dr. Burton Chance
Dr. S. Solis Cohen
Dr. T. V. Crandall
Dr. Edward P. Davis
Dr. L. W. Deichler
Dr. Francis X. Dercum
Dr. W. A. Newman Dorland
Dr. A. A. Eshner
Dr. Henry M. Fisher
Dr. J. P. Crozer Griffith
Dr. Hobart A. Hare
Dr. Addinell Hewson
Dr. C. F. Judson
Dr. W. W. Keen
Dr. Robert G. Le Conte
Dr. Morris J. Lewis
The J. B. Lippincott Company
Dr. Daniel Longaker
Dr. Charles K. Mills
Dr. Charles C. Norris
Dr. Francis R. Packard
The Henry Phipps Institute
The Philadelphia Bureau of Health
Dr. George M. Piersol
Dr. David Riesman
Dr. John B. Roberts
Dr. Paul Sartain
The W. B. Saunders Company
Dr. George E. de Schweinitz
Dr. J. D. Seiberling
Dr. Alfred Stengel
Dr. T. Turner Thomas
U. S. Department of the Interior
U. S. Public Health Service
Dr. John K. Walker
Dr. H. R. Wharton
The S. S. White Dental Company
Dr. George B. Wood
Mr. Frank Zentmayer

1017 new publications were added to the Library during the past year, viz: United States, 284; Great Britain and Colonies, 189; France, 192; Germany, 302; Italy, 32; all other Countries, 18. Of these new publications, 30 were written or edited by Fellows of the College.

18 volumes were presented by the following authors or editors:

Dr. John R. Brinkley
Dr. Francis X. Dercum
Dr. J. W. Echols
Mr. Frederick Erdman
Dr. Hobart A. Hare
Dr. Hobart A. Hare (Editor)
Dr. A. D. Heinemann
Dr. H. Kosokabe
Dr. Ross Hall Skillern (Editor)
Dr. Herbert R. Spencer
Mr. Francis J. Stokes
Dr. Eugene S. Talbot
Mr. James Todd
Dr. John P. Turner
Dr. Albert Vilar
Dr. J. Collins Warren
Dr. Igie Pulliam Wettendorf

2 volumes were sent by the publishers at the request of the following authors or editors:

Dr. Eldridge L. Eliason
Dr. Ward Giltner

Summary of the "Funds":

	Volumes purchased.	Cost.
Henrietta Rush Fales Baker Fund	84	$524.17
Luther S. Bent Fund	17	34.62
William T. Carter Fund	79	264.35
Girardus Clarkson Fund	8	13.43
Francis X. Dercum Fund	94	333.92
Louis A. Duhring Fund	42	394.15
John D. Griscom Fund	105	542.37
William F. Jenks Fund	101	730.30
Oliver A. Judson Fund	3	42.10
William V. and John M. Keating Fund	25	49.20
William W. Keen Fund	55	216.51
Library Endowment Fund	292	2,465.88
Horace Magee Memorial Fund	61	518.61
J. Ewing Mears Fund	70	228.00
Charles K. Mills Fund	..	.....
Weir Mitchell Fund	35	521.50
John H. Musser Fund	15	44.21
Elizabeth K. Newcomet Fund	23	44.31
William F. Norris Fund	42	765.78
Charles A. Oliver Fund	13	25.54
Philadelphia Medical Society Fund	5	22.47
Lewis Rodman Fund	93	432.44
Douglas Stockton Warren Fund	50	179.19
John F. Weightman Fund	5	16.77
Caspar Wistar Fund	107	521.16
	1,434	$8,930.98

Special Accounts:

	Volumes purchased.	Cost.
Fund for completing files of journals . . .	138	$190.76
Fund for rare and valuable books	51	999.65
S. D. Gross Library Account	40	247.69
	229	$1,438.10

George B. Wood Fund—Library supplies, stationery, etc. Expended $348.96.

Morris Longstreth Library Fund—On account of salaries. Expended $892.50.

Catalogue Endowment Fund—On account of salaries. Expended $32.50.

Louis A. Duhring Fund—General purposes of the Library. Expended $9,407.50.

Books bound, 1,006.

Use of the Library: Visitors, 6,144; Fellows, 2,152; Total, 8,296.

The Library has been kept open two evenings each week and on the six minor legal holidays, for the same hours and period of time, as during the past year:

	Visitors.	Fellows.	Total.
Evenings.			
77	608	293	901
Legal holidays.			
6	79	27	106

The above figures are included in the total given for the year.

	1922.	1921.	Increase.
Number of books consulted in the Library . . .	18,918	16,333	2,585

The number of books reported as "consulted in the Library" includes only those supplied on demand. Readers have access to the bound volumes of periodicals and works of reference kept on the shelves in the Reading Room, and the Fellows have access to the Book-Stacks. There are, therefore, a great many volumes consulted of which no accurate record can be kept.

	1922.	1921.	Decrease.
Number of books taken out	3,186	3,419	233

Use of Study-Rooms: Average number of rooms in use throughout the year: 5. Greatest number in use at one time: 6. Daily average of the number of volumes in use in these rooms: 131.

Cataloguing: Works, 2,044; Volumes, 2,226; Cards written, 9,554; Printed cards revised, 2,956.

All books added to the shelves during the past year and 177 of the more important pamphlets have been catalogued and shelf-listed; and all bound volumes, including periodicals, transactions and reports have been accessioned.

Revision of the Catalogue: 4,101 cards have been revised, rewritten and filed.

6,825 unbound pamphlets and reprints have been subject-headed and arranged alphabetically by subject, and by author under the subject. The binding of pamphlets by subject is still held in abeyance on account of the excessive charges occasioned by labor conditions.

We have listed November 1, 1922, 1,192 current periodical publications, including "Transactions" and "Reports," obtained through the following sources:

	American.	Foreign.
Endowment Funds	74	458
By purchase from General Account	37	127
In exchange	61	91
Editors	104	14
Publishers	20	2
In addition, current numbers of periodicals have been received, at stated intervals, through the courtesy of the editor of the *Therapeutic Gazette*	26	30
	322	722
Reports, not included in the above	135	13
	457	735

The actual number of periodicals received during the year, including new subscriptions (3 American and 20 Foreign), total 930. This is an increase of 24 over the previous year. We are still carrying our lists intact and changes are made only when official notification is received from our Agents or from the journals themselves. This plan it seems advisable to continue for some time to come.

The following is a list of the foreign schools of medicine with which we exchanged publications prior to the war; for the present, as in the case of periodicals, it seems advisable to keep this list intact:

University of	Amsterdam	University of	Königsberg
"	Basel	"	Lausanne
"	Berlin	"	Leiden
"	Bern	"	Leipzig
"	Bonn	"	Liège
"	Breslau	"	Lund
"	Erlangen	"	Marburg
"	Geneva	"	Rostock
"	Giessen	"	Strassburg
"	Göttingen	"	Upsala
"	Greifswald	"	Utrecht
"	Halle	"	Würzburg
"	Heidelberg	"	Zurich
"	Kiel		

Faculty of	Medicine of	Bruxelles
"	"	Paris
"	"	Toulouse
"	"	Yucatan

We have heard, during the past year, from Basel, Bern, Bonn, Breslau, Giessen, Halle, Kiel, Königsberg, Lausanne, Leiden, Leipzig, Marburg, Toulouse and Würzburg. 1,878 dissertations and 231 theses have been added to our collection.

We have received in cash from the sale of duplicates for the current year ending November 1, 1922: $629.33.

During the past year we have distributed books and journals, on exchange account, to the following:

Boston Medical Library
Emory University, Georgia
Medical Library Association, Baltimore
Medical Library, McGill University, Montreal, Canada
Medical Society of the County of Kings, Brooklyn

And have received exchanges from:

Boston Medical Library
Emory University, Georgia
L'Institut Sêrotherapique de l'État Danois, Copenhagen
Mayo Clinic Library, Rochester, Minn.
Medical Library Association, Baltimore
Medical Library, McGill University, Montreal, Canada
Medical Society of the County of Kings, Brooklyn

With the aid received from exchanges and purchases made with funds appropriated for the purpose by the Library Committee, we have, since November 1, 1921, completed the files of the following journals:

Annali di Clinica Medica, Palermo
Archiv für experimentelle Pathologie und Pharmakologie, Leipzig
Archiv für Geschichte der Medizin, Leipzig
Archivio di Fisiologia, Firenze
Archivio Italiano di Otologia, Rinologia e Laringologia, Palermo
Archivio di Ortopedia, Milano
Centralblatt für Gewerbehygiene, Berlin
Internationales Centralblatt für Laryngologie, Rhinologie und verwandte Wissenschaften, Berlin
Jahrbücher der in- und ausländischen gesammten Medicin (Schmidt), Bonn
Rivista Ospedaliera, Roma
Rivista di Patologia Nervosa e Mentale, Firenze
Zeitschrft für angewandte Psychologie und psychologische Sammelforschung, Leipzig
Zentralblatt für chirurgische und mechanische Orthopädie, Berlin

Amount of fines collected from November 1, 1921, to November 1, 1922: $90.95.

The following is a list of the rare medical books and works of special interest received during the past year:

INCUNABULA

[Total number of incunabula at this date, 336 Titles, 316 Volumes]

Albertus Magnus. [De anima lib. III.] Venetiis, Raynaldus de Novimagio, 1481. [Hain 496.]

Fund for Rare Books.

Albertus Magnus. [Opus de animalibus.] Venetiis, Johannes et Gregorius Gregoriis de Forlivio, 1495. [Hain 547.]

Louis A. Duhring Fund.

Andreae, Antonius. Quaestiones de tribus principiis rerum naturalium. Patavii, Laurentius Canozius Lendenariensis, 1475. [Hain-Copinger, 990.] William F. Norris Fund.

Aquino, Thomas de. [Commentum in octo libros physicorum Aristotelis.] Venetiis, Petrus Bergomensis, 1500.

[*Not in Hain.*]

Fund for Rare Books.

[Articella.] [F. 1a.:] Artesela. Venetiis, Philippus Pintus der Caneto, Mantuanus, 1491. [Hain 1871.]

Louis A. Duhring Fund.

Avicenna. Liber canonis primus quem princeps aboali abinsceni de medicina edidit, translatus a magistro Gerardo cremonensi in toleto ab arabico in latinu[m].*** Venetiis, Bonetus Locatellus for Octavianus Scotus, 1490. [Hain 2206.]

Henrietta Rush Fales Baker Fund.

Bossus, Matthaeus. De veris et salutaribus animi gaudii dialogus]. Florentiae, Franciscus Bonacursiis Florentinus, 1491. [Hain 3672.

Fund for Rare Books.

1490. [Hain 6900.]

[Fagifacetus s. de facetia et moribus mensae.] Basileae [Michael Furter]

[*First Edition.*]

Fund for Rare Books.

Ficinus Florentinus, Marsilius. Platonica theologia de animorum immortalitate. Florentiae, Antonius Bartholomaei Mischominus, 1482. [Hain 7075.]

Rare first edition. Beautifully printed book.

John D. Griscom Fund.

Hippocrates. [Tractatus de natura hominis et alia opuscula, Andrea Brentio interprete.] [Romae, Stephanus Plannck, circa 1480.] [Hain 8669.]

Fund for Rare Books.

Hippocrates. [Tractatus de natura hominis et alia opuscula, Andrea Brentio interprete.] [Romae, Stephanus Plannck, circa 1490.] [Hain 8670.]

Fund for Rare Books.

[Institoris, Henricus.] Malleus maleficarum. [Speier, Peter Drach, 1492.] [Hain 9240.]

Extremely rare edition.

Fund for Rare Books.

Johannes Mercurius. Contra pestem.*** [Romae, Johannes Besicken, 1493.]

[*Not in Hain.*] [*Only copy known—Voynich.*]

Horace Magee Memorial Fund.

Lacepiera, Petro. Liber de oculo morali.*** Venetiis, Johannes Hamman de Landovia, dictus Hertzog, 1496. [Hain 9804.]

Fund for Rare Books.

Leonicenus, Nicolaus. [De Plinii et aliorum in medicina erroribus.] Ferrariae, Laurentius de Rubeis (Rossi) de Valentia et Andreas de Castro Novo, 1492. [Hain 10021.]

Fund for Rare Books.

Magister de Magistris, Johannes. [Quaestiones super tota philosophia naturali.] Parmae [Damianus de Moyllis] 1481. [Hain 10447.]

From the Library of Pierre Duhem, with his book-label and with the arms of Christopher Monck, Second Duke of Albemarle, on both covers.

Fund for Rare Books.

Magni, Jacobus [Le Grand, Jacques.] [Zophilogium s. sophologium.]*** [Argentorati, Rysch, circa 1470.] [Hain 10472.]

Editio princeps of an extremely rare and fine specimen of typography. With the peculiar "R" which is responsible for the name under which this press is known. Famous and popular work during the XVth century; translated into English by Caxton under the title "A book of good manners."

Presented by Henry Reed Hatfield, Esq.

Maimonides, R. Moses. [De regimine sanitatis ad Soldanum Babyloniae.] Florentiae, Monasterium S. Jacobi de Ripoli [1477]. [Hain 10525.]

Fund for Rare Books.

Paulus Venetus, Nicolettus. [Expositio librorum naturalium Aristotelis.] Mediolani, Christophorus Valdarfer Ratisponensis, 1476. [Hain 12516.]

William F. Norris Fund.

Sabunde, Raymundus de. Theologia naturalis s. liber creaturarum.*** Daventriae, Richard Paffroed de Colonia [circa 1480]. [Hain 14067.]

Rare first edition of a celebrated work, which was translated into French by Montaigne.

Fund for Rare Books.

Works of Special Interest

Abercromby, David. Fur Academicus. Amstelodami, Wolfgang, 1689.

Rare first edition.

Henrietta Rush Fales Baker Fund.

Abraham Aben Ezra. Astrologi peritissimi in re judiciali,*** ab Petro de Abano post accuratam castigationem in latinum traducta. Venetiis, Liechtenstein, 1507.

Fund for Rare Books.

Acakia, Martinus. Synopsis eorum quae quinque prioribus libris Galeni de facultatibus simplicium medicamentorum continentur. Parisiis, apud Wechelum, 1555.

Presented by J. Solis Cohen, M.D.

Agrippa, Henricus Cornelius. Opera in duo tomos concinne digesta.*** Lugduni, Beringus, 1531.

Horace Magee Memorial Fund.

Albertus Magnus. De secretis mulierum libellus, scholiis auctus, et a mendis repurgatus.*** Lugduni, de Harsy, 1598.
William F. Jenks Fund.

ab Altomari, Donatus Antonius. De medendis febribus ars medica. Venetiis, ex off. Marci de Maria Salernitani, 1562.
John D. Griscom Fund.

Argenterius, Joannes. De consultationibus medicis siue (ut vulgus vocat) de collegiandi ratione liber. Florentiae, Torrentinus, 1551.
Fund for Rare Books.

Ballonius, Gulielmus. Epidemiorum et ephemeridum libri duo, studio et opera Iacobi Thevart. Parisiis, Quesnel, 1640.
Fund for Rare Books.

Bertuccio, Nicolaus. Nusq[uam] antea impressum collectorium totius fere medicine.*** Lugd[uni] Trote, 1509.
Fund for Rare Books.

Bevilaqua, Antonius. Tractatus specialis de curatione febrium malignarum.*** Graecii, Widmanstad, 1682.
Fund for Rare Books.

Bolnest, Edward. Aurora chymica; or, A rational way of preparing animals, vegetables and minerals for a physical life. London, Ratcliffe, 1672.
Fund for Rare Books.

Bologna. Raccolta di tutti li bandi, ordini, e provisioni fatti per la citta di Bologna in tempo di contagio imminente, e presente, li anni 1628, 1629, 1630, e 1631. Bologna, Camerale, 1631.
Fund for Rare Books.

Bologna. Scelta, compendio, et raccolta d'alcuni medicamenti rationali, quali tanto ne'nobili,*** raccolti e composti dal Francesco Muratori [et al.].*** Bologna, Benacci, 1630.
Fund for Rare Books.

Bonaccorsi, Bartolomeo. Della natura de polsi. Bologna, Monti, 1647.
Fund for Rare Books.

Bretini, Anton Francesco. La medicina difesa dalle calunnie degli uomini volgarie, e dalle opposizioni de'dotti.*** Lucca, Marescandoli, 1699.

First edition.

Caspar Wistar Fund.

Bright, T[imothy]. Treatise of melancholie; containing the causes thereof, and reasons of the strange effects it worketh in our minds.*** London, Vautrollier, 1586.

Fund for Rare Books.

Brown, Thomas. Nature's Cabinet Unlocked.*** London, Farnham, 1657.

Fund for Rare Books.

Brunfels, Otho. Herbarum vivae eicones ad naturae imitationem sum[m]a cum diligentia et artificio effigiatae.*** 3 Vols. in 1. Argentorati, Schott, 1532–1536.

Fund for Rare Books.

Campanella, Thomas. Medicinalium juxta propria principia libri septem. Opus non solum medicis, sed omnibus naturae et privatae valetudinis studiosis utilissimum. Lugduni, Pillehotte, 1635.

Rare first edition.

William F. Norris Fund.

Cardanus, Hieronymus. Livres intitulez de la subtilité et subtiles inventions, ensemble les causes occultes et raisons d'icelles. Traduits de Latin et François par Richard le Blanc. Rouen, du Bosc, 1642.

Fund for Rare Books.

Champerius, Symphorianus. Practica nova in medicina. 2 Ed. Lugduni, Marion, 1517.

Voluminous contemporary manuscript notes.

Fund for Rare Books.

Champerius, Symphorianus. Rosa Gallica aggregatoris.*** [Valentia Allobrogum, Badius, 1514.]

Fund for Rare Books.

Charleton, Gualterus. Two Discourses. 1. Concerning the different wits of men.*** 2. The mysterie of vintners.*** London, Whitwood, 1669.

William T. Carter Fund.

Cheyne, George. English malady; or, A treatise of nervous diseases of all kinds, as spleen, vapours, lowness of spirits, hypochondrical and hysterical distempers, etc. In three parts.*** London, Strahan, 1733.

Horace Magee Memorial Fund.

Cordus, Valerius. Dispensatorium, hoc est, pharmacorum conficiendorum ratio appendix ex scriptis Jacobi Syluij.*** Venetiis, Bosellus, 1556.

Douglas Stockton Warren Memorial Fund.

Dalecampius, Jacobus. De peste libri tres. Lugduni, apud Rouillium, 1552.

Fund for Rare Books.

Descartes, Renatus. Discours de la methode pour bien conduire sa raison, et chercher la verite' dans les sciences.*** Paris, Girard, 1668.

William F. Norris Fund.

[Dufour de la Crespelière.] Recueil choisy d'epigrammes des plus fameux poetes Latins, mis en vers François. Textes de l'eschole de Salerne. Paris, de Varennes, 1686.

Rare edition.

John D. Griscom Fund.

Epiphanius, Saint. Contra octoaginta haereses opus, Panarium; sive, Arcula, aut Capsula medica appellatum, continens libros tres, et tomos siue sectiones ex toto septem.*** Iano Cornario interprete. Basileae, ex off. Hervagiana, 1578.

Fund for Rare Books.

Erastus, Thomas. Varia opuscula medica quae cum ipse studiosis communicare statuisset, morte praeuentus, in lucem edere non potuit.*** Francof. ad M., Castelvitreus, 1590.

Rare first edition.

Fund for Rare Books.

Eyre, Henry. Brief account of the Holt waters, containing one hundred and twelve eminent cures, perform'd by the use of the famous mineral waters at Holt (near Bath) in Wiltshire. To which are added some directions for drinking the Holt waters and some experimental observations on the several wells. London, Roberts, 1731.

Lewis Rodman Fund.

Fabricius ab Aquapendente, Hieronymus. De formato foetu. Venetiis, Bolzetta, 1620.

Fund for Rare Books.

Falloppio, Gabriel. Opuscula. Patavii, Bertellus, 1566.

Fund for Rare Books.

The famous history of Friar Bacon; containing the wonderful things that he did in his life; also the manner of his death; with the lives and deaths of the two conjurors, Bungey and Vandermast. London, Hollis [1700].

Horace Magee Memorial Fund.

Ferri, Alfonsus. De ligni sancti multiplici medicina et vini exhibitione, libri quatuor. Lugduni, Frellonius, 1547.

Fund for Rare Books.

François, Gerard. Les trois premiers livres de la santé. Paris, Richer, 1583.

Caspar Wistar Fund.

Fuchs, Leonhard. Paradoxorum medicinae libri tres, in quibus sane multa à nemine hactenus prodita. Venetiis, Rauani, 1547.

Fund for Rare Books.

Gäbelkhouer, Osswaldt. Boock of physicke*** faithfullye translated out of High-duche by*** Charles Battus*** and now nuelye translated out of Low-duche into Englishe by A. M. Dorte, Caen, 1599.

Fund for Rare Books.

Galen, Claudius. Librorum quinta classis eam medicinae partem.*** 6 Ed. Venetiis, apud Iuntas, 1586.

[*Engraved title-page.*]

Presented by Joseph Walsh, M.D.

Gariopontus. Ad totius corporius aegritudines remediorum*** libri V. Eiusdem de febribus, atque earum symptomatis libri II. Recens typis commissi et multis in locis suae integritati restituti. Basileae, Petrus, 1531.

First and only edition.

William F. Norris Fund.

Garmann, Christianus Fridericus. De miraculis mortuorum libri tres, quibus praemissa dissertatio de cadavere et miraculis in genere,*** editum a L. Immanuale Heinrico Garmanno. 2 Vols. Dresdae, Zimmermanni, 1709.

Rare second enlarged edition.

Henrietta Rush Fales Baker Fund.

Guainerio, Theodoro. Il trattato delle fontane et acque di Ritorbio. Lione, Gionti, 1577.

Henrietta Rush Fales Baker Fund.

Guarinonius, Christophorus. Consilia medicinalia in quibus universa praxis medica. Venetiis, Baglionus, 1610.

Horace Magee Memorial Fund.

Guy de Chauliac. La grande chirurgie.*** Restituée par Laurens Joubert. Tournon, Michel, 1619.

Horace Magee Memorial Fund.

Helvetius, Joh. Fridericus. The golden calf, which the world adores, and desires.*** Written in Latin and faithfully Englished. London, Starkey, 1670.

Caspar Wistar Fund.

Hollerius Stempanus, Jacobus. De morborum curatione, eiusdem de febribus, de peste, de remediis*** in Galeni libros, de materia chyrurgia. Desiderii Iacotii Vandoperani, et Chrystophori Burgensis Consolentanei opera nunc primum (praeter chyrurgiam) in lucem aedita, et Scholiis illustrata. Parisiis, apud Jacobum Maceum, 1565.

Fund for Rare Books.

Janin de Combe Blanche, Jean. L'antiméphitique ou moyens de détruie les exhalaisons pernicieuses et mortelles des fosses d'aisance, l'odeur infecte des egouts, celle des hôpitaux, des prisons, des vaisseaux de guerre.*** Paris, Pierres, 1782.

William T. Carter Fund.

Lancetta, Troilo. Di pestilenza commune a bruti, et di contaggio mortale dell'huomo opera.*** Venetia, Guerigli, 1632.

John D. Griscom Fund.

Langnerius, Andreas. Instruttione preciosissima per diffendersi da qualunque sospetto di contaggio, con il modo facilissimo di rissanar quelli, che fossero infetti.*** Bologna, Cataneo, 1630.

Fund for Rare Books.

Lemosius, Ludovicus. De optima praedicendi ratione, libri sex.*** Item Iudicij operum Magni Hippocratis, liber unus. Venetiis, Meietus, 1592.

Fund for Rare Books.

Liddel, Duncan. Ars Medica, succinctè et perspicuè explicata. Hamburgi, ex bib. Frobeniano, 1608.

Belonged to John Redman Coxe. Bound in vellum rubricated musical manuscript. Has manuscript index in contemporary hand.

Presented by J. Solis Cohen, M.D.

Lommius, Jodocus. De curandis febribus continuis liber, in quattuor divisus sectiones, quarum singulae singulorum morbi temporum quae totidem quoque sunt numero remedia continent. Antverpiae, Gulielmi Siluij, 1563.

Fund for Rare Books.

Lully, Raymund. Mercuriorum liber iam tandem subsido manuscripti exemplaris perfecte editus. Item eiusdem apertorium, repertorium, artis intellectuae theorica et practica, magia naturalis, opuscula plane aurea. Coloniae Agrippinae, Birckmann, 1567.

Rare edition.

Fund for Rare Books.

Lully, Raymund. Practica co[m]pendiosa*** per Bernardu[m] de lauinheta*** edita. Lugduni, Joannes Moylin al[ia]s de Cambray, 1523.

Fund for Rare Books.

Maier, Michael. Arcana arcanissima hoc est hieroglyphica aegyptiograeca, vulgo necdum cognita.*** [Francofurti, Hoffmann, 1619.]

Exceedingly rare.

Fund for Rare Books.

Manzini, Carlo Antonio. L'occhiale all'occhio dioptrica pratica.*** Doue si tratta della luce; della refrattione de raggi; dell'occhio; della vista; e de gli aiuti che dare si possono à gli occhi per vedere quasi l'impossible.*** Bologna, Benacci, 1660.

Rare first edition of the second book written on spectacles.

John D. Griscom Fund.

Martinengus, Celsus. De praevidendis morborum eventibus libri tres. Ejusdem de methodis commentarius, de[que] artium structura libellus. Venetiis, Somaschus, 1584.

Fund for Rare Books.

Martinus, Joannes. Claudius Galeni Pergameni vita.*** Neapoli, apud Saluianum, 1577.

Lewis Rodman Fund.

Minadous, Aurelius. Tractatus de virulentia venerea. In quo omnium aliorum hac de re sententiae considerantur; mali natura explicatur; caussae, et differentiae aliaque cum dogmatica curatione proponuntur.*** Venetiis, Meiettus, 1596.

Fund for Rare Books.

Moreau de Saint-Elier abbé. Traité de la communication des maladies et des passions; avec un essai pour servir à l'histoire naturelle de l'homme. La Haye, Van Duren, 1738.

Fund for Rare Books.

[Moulton, Thomas]. Myrrour or glasse of health.*** [London, Vele, 1550.]

Fund for Rare Books.

Paracelsus [Bombastus ab Hohenheim] Aureolus Philippus Theophrastus. Vade mecum; das ist, Etliche sehr nutzliche Tractat durch*** B. G. Penotum in Latein hrsg.*** in unsere vernemliche Muttersprache transferiret durch Iohannem Hippodamum.*** Eissleben, Hörnigk, 1597.

Rare edition. Published at Magdeburg in 1596 *and again in* 1608.

John D. Griscom Fund.

Peruca, Rainero. Apologia de medici opera; in risposta d'altra di Rafaello Carrara intitolata le confusioni de medici.*** Milano, Monza, 1655

Horace Magee Memorial Fund.

Petrus, Cornelius. Annotatiunculae aliquot in quatuor libros Dioscorides Anazarbei.*** Antuerpiae, Grapheus, 1533.

Horace Magee Memorial Fund.

Plempius, Vopiscus Fortunatus. Ophthalmographia sive tractatio de oculo. Editio tertia. Lovanii, Nempaei, 1659.

Fund for Rare Books.

Plinius, Cajus Secundus. In libros naturalis hystorie epistola, cu[m] Joha[n]nis Aestca[m]piani*** epistolio. L[e]iptz[i]k, Wolfgang [Stockel] 1508.

Rare edition. The Greek words are printed from wood blocks and not from movable type.

Fund for Rare Books.

Plinius, Cajus Secundus. Naturae historiarum libri XXXVII è castigationibus Hermolai Barbari*** additu est*** index Ioannis Camertis Minoritani.*** Hagenoae, typ. Badensis, 1518.

[*ff. clxxxvi–clxxxviii and cxc MSS.*]

Fund for Rare Books.

de Porcastris, Sigismundus. [Quaestiones.] Venetiis, Pentius, 1506.

Extremely rare first edition.

Fund for Rare Books.

Porta, Giovanni Battista. Phytognomonica octo libris.*** Neapoli, apud Saluianum, 1589.

Rare second edition of a celebrated work.

Fund for Rare Books.

Portius, Simon. De coloribus libellus*** Latinitate donatus, et commentarijs, illustratus; una cum eiusdem praefatione, qua coloris naturam declarat. Florentiae, apud Laurentium Torrentinum, 1548.

Rare first edition.

John D. Griscom Fund.

Portius, Simon. De dolore. Florentiae, apud Laurentium Torrentinum, 1551.

Fund for Rare Books.

Portius, Simon. De humana mente disputatio. Florentiae, apud Laurentium Torrentinum, 1551.

Francis X. Dercum Fund.

Reconditorium ac reclusorium opulentia sapientiaeque numinis mundi magni, cui deditur in titulum chymica vannus. Amstelodami, Janssonius, 1666.

Rare first edition and first Latin edition.

Caspar Wistar Fund.

Rota, Michael. Angelus. De peste Veneta. Anno MDCXXX. Venetiis, apud Ghirardum de Imbertis, 1634.

John D. Griscom Fund.

Salernum, School of. Regimen sanitatis Salerni. This booke teachyng all people to governe them in healthe is translated out of the Latyne tonge in to Englyshe by Thomas Paynell, which boke is ame[n]ded, augmented and diligently imprynted. London, Vele, 1557.

Rare first Veale edition.

Fund for Rare Books.

Saxonia, Hercules. Luis venereae perfectissimus tractatus; ex ore*** exceptus, in capita distinctus, indice locupletatus, lucique datus opera Andreghetti Andreghettii. Patavii, Pasquatus, 1597.

Fund for Rare Books.

Scheiner, Christophorus. Oculus; hoc est fundamentum opticum; in quo ex accurata oculi.*** Londini, Flesher, 1652.

Fund for Rare Books.

Sorapan de Rieros, Juan. Medicina española contenida en proverbios vulgares de nuestra lengua muy provechosa para todo genero de estados para philosophos y medicos para theologos y juristas para el bueno regimiento de la salud y mas larga vida. [Madrid] Zambrano, 1616.

Engraved frontispiece by Huylan. Remarkable work which investigates all Spanish proverbs from medical point of view.

Horace Magee Memorial Fund.

Tagaultius, Joannes. Commentariorum de purgantibus medicamentis simp icibus libri II in gratiam pharmacopoeia candidatorum, nuper in lucem editi. Lugduni, Rouillius, 1549.

Fund for Rare Books.

Telesius, Bernardinus. Varii de naturalibus rebus libelli ab Antonio Persio editi.*** Venetiis, Valgrisus, 1590.

Horace Magee Memorial Fund.

Theobaldus, Zacharias. Arcana naturae. Das ist: Sonderliche geheimnus der Natur so wol aus glaubwirdigen Autoribus, als aus aigner erfahrung zusammen getragen.*** Nürnberg, Lochner, 1628.

Rare first edition.

Lewis Rodman Fund.

Versehung leibs und seel; ein nützlichs artzenei Büchlin. Leibliche gesundtheit zuerhalten.*** Franckfurt am Mein, Egenolff, 1541.

A book of great rarity and interest.

Fund for Rare Books.

[Vesalius, Andreas]. Ticianus inventor et delineaut. Dominicus Bonauera. sculpsit. Notomie di Titiano. [Vinegia, 1680.]

Rare first edition.

Fund for Rare Books.

de Villalobos, Francesco Lopez. Congressiones (et epistolæ familiares). Salamantina, Laurentius de Lion, 1514.

Possibly the only copy in existence with the two pages of errata. Only one copy recorded, which does not contain the errata.

Presented by Henry Reed Hatfield, Esq.

Von der Pestilentz Kurtzer und einseltiger Bericht.*** Erffurt, Starck, 1597.

Fund for Rare Books.

Manuscripts

Artzney Buch.*** [Berlin, 1747.]

Fund for Rare Books.

Chapman, Nathaniel. Notes on the lectures of Nathaniel Chapman, professor of the institutes and practice of physic and clinical practice in the University of Pennsylvania, Philadelphia. 1818–19–20. [Recorded by] R. E. Griffith, Jr. [Phila., 1818.]

Presented by Francis Fisher Kane, Esq.

Human longevity or anecdotes of persons who have lived to the age of one hundred years and upwards. [London, 1700.] [Phillipps MS. 9402.]

William T. Carter Fund.

Ruston, Thomas. Twenty-two manuscripts and documents.

Presented by John F. Lewis, Esq.

Other Interesting Additions.

A large framed water-color painting of snakes of India, painted by Prosacl Baychee, Student, Government School of Art, Calcutta, for Sir Joseph Fayrer and presented by him to Dr. S. Weir Mitchell, who in

turn gave it to Dr. John K. Mitchell. After Dr. John K. Mitchell's death, it became the property of Dr. W. W. Keen.

Presented by W. W. Keen, M.D.

A bronze medal commemorating the semi-centennial meeting of the American Public Health Association, New York, 1872–1922, noteworthy because of the participation of its founder, Doctor Stephen Smith, born February 19, 1823.

Presented by M. P. Ravenel, M.D.

We have also received during the year a number of interesting and more or less valuable autograph letters.

Use of the Photostat: During the past year there have been furnished to Fellows of the College 431 prints; and to others than Fellows, on application, 92 prints. These outside applications include requests from Boston; Chicago; Cleveland; Hot Springs, Virginia; Madison, Wisconsin; New York; Philadelphia; Rutherfordton, North Carolina; and Thomas, West Virginia.

The work for the Library has been continued according to the original instructions of the Committee; 6,140 large and small prints have been made; 25 volumes of incunabula completed as well as various portraits and manuscripts; also, through the courtesy of the Boston Medical Library, an excellent photostat reproduction of "An Essay on the Shaking Palsy" by James Parkinson, London, 1817, a work which was not in the library and very difficult to obtain. Photostat copies were also made of "De Vulneribus Capitis," by Laurentius Antonius Dercum, 1715, and "De Rosa," by Philippus Valentinus Dercum, 1751, from the originals in the Library of the Surgeon-General's Office, and bound copies were presented to the Library by Dr. Francis X. Dercum.

Up to the present time there have been made Photostat copies of 176 incunabula.

There was an increase to the principal of the Library Endowment Funds during the past year of $136.90; but practically no additions. The total of the Library Endowment Funds at this date is $357,633.92.

An account of stock has been taken in connection with the shelf-list, and any displacements found arranged in order.

There has been an increase in the number of visitors to the Library over the preceding year of 1,048; an increase in the number of books reported as consulted in the Library of 2,585; and a decrease in the number of books taken out of 233.

These figures are interesting as indicative, in a degree, of the literary activity of the medical profession of Philadelphia and its vicinity, but of no value as an indication of the progress and capabilities of the Library.

In regard to binding, conditions remain practically the same as last year; prices are excessive and from lack of funds fewer volumes have been bound than for the preceding year; the Committee was obliged to charge the binding of the books purchased through the special funds to the various special funds themselves, which is a distinct disadvantage. Until there is some betterment in labor conditions, or until the income of the Library Committee is sufficiently increased for the purpose, only the more important periodicals and books can be sent to the binders.

LIBRARY COMMITTEE,
FRANCIS X. DERCUM, M.D.,
Chairman.

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